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ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

Methods of Mining Copper in Arizona—I
By George J. Young

A Deposit of China Clay in Ontario
By H. Sydney Hancock, Jr.

Bauxite on the Gold Coast
By Lloyd T. Emory

Welfare Work at Anyox
By F. M. Kelley

Montreal Meeting of Canadian Institute
of Mining and Metallurgy

Ore Deposition at Randsburg, California
A Review by J. E Spurr

No. 2 shaft
Ray Consolidated Copper Co.
Ray, Arizona

Mining Stocks—Week Ended February 27, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	48⅜	46⅛	46⅞	Ja.16,Fe.23,Q	0.75
Arcadian Consol.	Boston	*45	*45	*45		
Ariz. Com'l.	Boston	12⅛	11⅛	11⅜	Jy.21,Jy.31 SA	0.50
Calaveras	N. Y. Curb	3⅛	3⅛	3⅜		
Calumet & Arizona	New York	61⅝	60	60⅞	Mr.5,Mr.21 QX	1.50
Calumet & Hecla	Boston	15	14⅛	14⅛	Nov.30,De.15 Q	0.50
Cerro de Pasco	New York	67⅛	63⅛	63⅞	Ja. 14, Fe. 1, Q	1.00
Chile Copper	New York	35⅜	33⅛	34	Ma.3,Ma.29,Q	0.62½
Chino	New York	20⅛	20⅛	20⅛	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	1⅛	1⅛	1⅜		
Copper Range	Boston	18⅜	18	18⅛	May, 1925	1.00
Crystal Copper	Boston Curb	*47	*45	*45		
East Butte	Boston	3⅛	3⅛	3⅛	Dec., 1919	0.50
First National	Boston Curb	*16	*16	*16	Feb., 1919	0.15
Franklin	Boston			*80		
Granby Consol.	New York	21⅛	20	20⅜	May, 1919	1.25
Greene-Cananea	New York	12⅜	11⅜	11⅜	Nov., 1920	0.50
Hancock	Boston	*50	*50	*50		
HoweSound,new,r.t.c.	New York	35⅛	32⅞	33⅛	Ja. 5, Ja. 15 Q	0.50
Inspiration Consl.	New York	25¼	23⅛	24	Mar.18, Ap.5,Q	0.50
Iron Cap	Boston Curb	3⅛	3⅛	3⅜	May, 1923	0.15
Isle Royale	Boston	11⅛	11⅛	11⅛	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	*1⅜	*1 13/16	*1 13/16		
Kennecott	New York	57⅛	55	55⅞	Ma.5,Ap.1 Q	1.00
Lake Copper	Boston	1	1	1	June, 1925	0.50
Magma Copper	New York	42⅞	41⅜	41⅜	De.31, Ja.15,	0.75
Mason Valley	N. Y. Curb	2⅛	2⅛	2⅛		
Mass Consolidated	Boston	*60	*35	*35	Nov., 1917	1.00
Miami Copper	New York	12⅜	12	12	Feb.1, Feb.15 Q	0.25
Mohawk	Boston	34	33	33	Jan. 30, Ma.1 Q	1.00
Mother Lode Coa.	New York	7⅛	7	7	De. 11, De. 31	0.37½
Nevada Consol.	New York	13⅞	13⅛	13⅛	De. 18, De.31 Q	0.25
New Cornelia	Boston	20⅛	19⅜	19⅛	Fe.5, Fe.23 Q	0.30
North Butte	Boston	3	2⅞	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*67	*62	*62	No. 14, De. 2	0.05
Old Dominion	Boston	18	17⅛	17⅜	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†135	†132	..	De.21, Ja.2 Q	1.00
Quincy	Boston	23⅞	20⅛	22	Mar., 1920	1.00
Ray Consolidated	New York	12⅛	11⅜	11⅜	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	..	..	11⅞		
St. Mary's Min. Ld.	Boston	35⅛	33⅛	33⅜	May, 1925	3.00
Seneca Copper	New York	8	7⅛	7⅛		
Shannon	Boston	*55	*50	*50	Nov., 1917	0.25
Shattuck Arizona	New York	59⅞	53	58	Jan., 1920	0.25
Superior & Boston	Boston	*85	*65	*65		
Tenn. C. & C.	New York	14⅞	13⅜	13⅜	Fe.27,Ma.15,Q	0.25
United Verde Ex.	N. Y. Curb	30⅛	29⅛	29⅛	Ja.5, Fe.1, Q	0.75
Utah Copper	New York	...	...	103	De.18, De.31,Q	1.25
Utah Metal & T	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*75	*75	*75		
Walker Mining	Salt Lake	1.20	1.15	1.17½		
NICKEL-COPPER						
Internat. Nickel	New York	42⅛	39⅛	39⅞	De.17,De.31,Q	0.50
Internat. Nickel, pfd.	New York	102⅛	102⅛	102⅛	Ja.25, Fe.1, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*37½	*36	*37	Ja. 1, Ja. 10 M	0.0½
National Lead	New York	167	155¼	158	Ma.12,Ma.31 Q	2.00
National Lead pfd.	New York	117	116	116	Aug.21, Se.15	1.75
St. Joseph Lead	New York	46	43⅞	44⅛	De.10,De.20 QX	1.50
ZINC						
Am. Z. L. & S.	New York	9⅛	9	9	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	41	35⅛	35⅝	Nov., 1920	1.50
Butte C. & Z	New York	5⅞	5⅛	5⅛	De.10, De.24	0.50
Butte & Superior	New York	14⅛	13	13⅛	De.15, De.31 Q	0.50
Callahan Zn-Ld	New York	2	2	2	Dec., 1920	0.50
Eagle Picher	Cincinnati	31⅛	31	31⅛	My. 15, Jn.1	0.40
Eagle Picher, pfd.	Cincinnati	...	...	110	Ja.1, 15.31	1.50
New Jersey Zn.	N. Y. Curb	...	...	208	Fe.10, Fe.28 Q	0.90
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*52½	*47½	*48½	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York	1⅝	1⅜	1⅜		
Argonaut	Toronto	*39	*33	*33		
Barry-Hollinger	Toronto	*48	*43	*44½		
Carson Hill	Boston	...	...	*45		
Consol. W. Dome L.	Toronto	*24½	*21	*22		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅜	2⅜	De.31, Ja. 7	0.10
Crown Reserve	Toronto	*20⅜	*16⅜	*16⅜	Jan., 1917	0.05
Dome Mines	New York	19⅛	18⅜	18⅜	De.31, Ja.20, Q	0.50
Golden Center	N. Y. Curb	1⅜	1⅛	1⅛		
Golden Cycle	Colo. Springs	†1.56	†1.54½		No.30, Dec.10 Q	0.03
Hollinger Consol	Toronto	19.20	19 00	19.00	Fe. 9, Fe. 25	0.08
Homestake Mining	New York	62	50⅛	50⅛	Fe.20,Fe.25 Mo	0.50
Kirkland Lake	Toronto	1.30	1.09	1.13		
Lake Shore	Toronto	11.50	10 95	10 95	Ma.1,Ma.15 Q	0.10
McIntyre-Porcupine	New York	27⅛	26	26	Fe.1, Ma.7	0.05
Newray	Toronto	*42	*40⅜	*40⅜		
Night Hawk Pen	Toronto	*9	*6	*6		
Noranda	N. Y. Curb	15⅜	14½	15 7/16		
Portland	Colo. Springs	†*61	†*56⅜	....	Oct., 1920	0.01
Rand Mines	New York	....	....	34⅜	Fe.16, Fe.26	1.52
Teck-Hughes	Toronto	3.65	3.35	3.42	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*52	*50	*50	Ma.10,Ma.20	0.02
Tough-Oakes	Toronto	*60	*49⅜	*56		
United Eastern	N. Y. Curb	...	...	*43	July, 1924	0.05
Vipond Cons.	Toronto	1.84	1.67	1.70		
Wright-Hargreaves	Toronto	8.85	8.55	8.55	De.15, Ja. 1 QX	0.10
Yukon-Alaska Trust	N. Y. Curb	20	20	20		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	21	20¼	20¾		
Con. Cortez	N. Y. Curb	*7	*6	*7		
Con. Virginia	San Francisco	*11½	*9½	*10½		
Continental Mines	N. Y. Curb	...	...	*45		
Dolores Esperanza	N. Y. Curb	68	60	61	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅝	2⅜	2⅜	De.18, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	4	3⅛	3⅜	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	59	52	57	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	7	6⅛	6⅛	Se.30, Oc.21	0.07½
Ynity Gold	N. Y. Curb	...	...	*20		
West End Consol.	N. Y. Curb	*25	*25	*25	Mar., 1923	0.05
Uukon Gold	N. Y. Curb	*45	*45	*45	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	..	..	1	Oct., 1920	0.50
Beaver Consol	Toronto	*86	*73	*75	May, 1920	0.03
Castle-Trethewey	Toronto	1.72	1.62	1.66		
Coniagas	Toronto	4.50	4.30	4.40	May, 1924	0.12½
Keeley	Toronto	1.71	1.54	1.56	Ma.1,Ma.15 X	0.12
Kerr Lake	N. Y. Curb	1⅜	1 3/16	1 3/16	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*28	*28	*28	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1	1	1	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*23½	*22	*22	Oct., 1920	0.03
Mining Corp. Can.	Toronto	4.45	4.00	4.12	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	6⅜	6	6	De.31, Ja.2, Q	0.15
Temiskaming	Toronto	*14	*14	14	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8⅛	7⅝	7⅞	De.15,Ja.2, X	0.25
Alta Merger	Salt Lake	†3	†1	..		
Bingham Mines	Boston	50	46½	46½	Ma.20,Ma.31 Q	1.00
Cardiff M. & M.	Salt Lake	..	..	*56	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.50	3.50	3.50	Fe. 1,	0.10
Emma Silver	Salt Lake	†1⅛	†1⅛	..		
Erupcion	Boston Curb	1⅝	1⅝	1⅝	De.15, Ja.2, X	0.10
Federal M. & S.	New York	91	91	91		
Federal M. & S., pfd.	New York	90⅝	75	75	No.25, De.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*24	*18	*20		
Hecla Mining	N. Y. Curb	17⅞	17⅛	17⅛	Fe.15, Ma.15 Q	0.50
Iron King Mining	Salt Lake	*35	*33	*33		
Keystone Mining	Salt Lake	..	..	*52	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*18	*16½	*18		
Mammoth Mining	Salt Lake	3.00	2.95	3.00	De. 16, De. 23	0.10
Marsh Mines	Spokane	*7⅛	*7	*7⅛	Se.15, Oc.1	0.15
Ontario Silver	New York	...	...	10		
Park Utah	Salt Lake	7.60	7.50	7.60	De.15, Ja.2	0.15
Prince Cons	Salt Lake	*75	*75	*75		
Silver King Coal	Salt Lake	9.35	9.30	9.30	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*47	*46	*46	De.31, Ja.10	0.02
Tamarack-Custer	Spokane	*47	*39	*39	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.62½	13.62½	13.62½	De.16,De.23,QX	0.30
Utah-Apex	Boston	9¾	9	9⅜	Ja.1, Ja.5, Q	0.35
Western Utah Copper	N. Y. Curb	...	...	*8		
IRON						
Bethlehem Steel	New York	43⅞	41	41⅞	July, 1924	1.25
Colorado Fuel & Iron	New York	35⅛	30⅛	31⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	26⅛	25⅛	25⅝	De. 4, De. 28,	0.75
Inland Steel	New York	38½	38	38	Fe.15, Ma.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅞	1⅛	1⅛		
Replogle Steel	New York	12⅞	11⅞	11⅞		
Republic I. & S.	New York	55⅞	52	52⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	94⅜	94	94⅛	Ma.15, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York	...	...	94⅛	De.10, De.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	126⅜	117	117	De.21, Ja.2, Q	1.75
U. S. Steel	New York	130	123⅜	125	Fe.27,Ma.30 XQ	1.75
U. S. Steel pfd	New York	126⅛	125⅝	125⅝	Fe. 3, Fe. 27, Q	1.75
Virginia I. C. & C.	New York	...	...	43	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	...	...	77	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	32⅝	30	31	Fe.1, Fe.15, Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	89½	88½	88½	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	115	111	111½	De.31, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	26	22⅛	22⅞	Nov., 1919	1.00
Texas Gulf	New York	139½	134½	135⅞	Ma.1, Ma.15,Q	2.50
DIAMONDS						
De Beers Consol.	New York	...	...	29	Ja.26, Fe.2	0.23
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅞	4⅛	4⅛		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	54⅝	52¼	53	Fe.18, Ma. 1, Q	1.00
Amer. Metal pfd.	New York	119	119	119	Fe. 19, Ma. 1, Q	1.75
Amer. Sm. & Ref.	New York	137	130	131	Ja.15, Fe.1,	1.75
Amer. Sm.&Ref.pfd.	New York	115½	114	114¾	Fe.5,Ma .1, Q	1.75
Consol. M. & S.	N. Y. Curb	...	...	*50	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	20	20	20		
Newmont Mining	N. Y. Curb	54	52½	52½	De.31, Ja.15,	0.60
Southwest Metals	N. Y. Curb	...	...	2		
U. S. Sm. R. & M.	New York	47	45	45	Ja.1, Ja.7, Q	0.87½
U.S. Sm. R.&M.pfd.	New York	48½	48½	48½	Ja.1, Ja.7, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and Henry Sachs; Colorado Springs, Colo.

PRICE WEEK ENDED FEBRUARY 16, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	80/7½	78/9	80/—	Feb. 1926	5 p.c.†
British Platinum (£1)	6/6	5/—	6/6	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	17/9	16/4½	17/6	Feb. 1926	6 annas*
Bwana M'Kubwa (5s)	7/9	7/—	7/4½		
Camp Bird (£1)	5/3	4/6	5/—		
El Oro (£1)	6/9	6/3	6/9	Nov. 1924	2½ p.c.*
Esperanza (10s)	2/—	1/7	1/10½		
Frontino & Bolivia (£1)	8/10½	8/9	8/9	Jan. 1926	1¼ p.c.
Mexican Corpn. (£1)	21/6	20/1½	20/6		
Mexico Mines of El Oro (£1)	37/3	36/3	36/3	Dec. 1925	12½ p.c.*
Nechi (pref. 10s)	1/6	1/—	1/6	1921–22	25 p.c.
Oroville Dredgng (£1)	4/—	3/10½	4/—	Dec. 1923	3½ p.c.
Ouro Preto (£1)	2/—	1/9	2/—	May 1925	2½ p.c.
St. John del Rey (£1)	10/9	10/1½	10/6	June 1925	6½ p.c.
San Francisco Mines (10s)	31/10½	30/—	30/9	Jan. 1926	22½ p.c.
Santa Gertrudis (£1)	21/4½	20/1½	20/9	July 1920	5 p.c.
Selukwe (2s. 6d.)	11/7½	10/4½	10/9	April 1917	6½ p.c.
S. Amer. Copper (2s.)	5/3	5/—	5/3	Nov. 1917	75 p.c.
Tanganyika (£1)	52/6	45/—	48/1½	Sept. 1925	5 p.c.
Tomboy (£1)	3/9	3/1½	3/9	Jan. 1926	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	6.750	6.560	6.695	July 1925	150 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.

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Contents

*Illustrated Article

Editorials	433
*Mining Engineers of Note James W. Wade	436
*Methods of Mining Copper in Arizona—I By George J. Young	437
*Bauxite on the Gold Coast By Lloyd T. Emory	443
*Welfare Work at Anyox, B. C. By F. M. Kelley	447
Discussion	449
Consultation	452
Mining News	453
Canadian Institute Meets at Montreal By E. H. Robie.	460
Men You Should Know About	462
Obituaries	462
Recent Technical Publications	463
*Ore Deposition at Randsburg, Calif. A Review by J. E. Spurr	
New Machinery	465
Markets	467
London's Influence on Domestic Lead and Zinc Prices	469
Company Reports	470
Mining Stocks	472
Searchlight Section	36-38
Professional Directory	39
What and Where to Buy	42
Advertising Index	46

Conveyors in Mining

IN NEARLY every issue of *Engineering and Mining Journal-Press* flow sheets are included in the articles describing new mills, smelters and refineries.

THESE flow sheets should be of interest and practical value to manufacturers of conveyor idlers, belting, anti-friction bearings, speed reducers, motors, etc., because they show graphically the large number of conveyors used in the new modern ore-treatment plants.

PRESENT-DAY milling practice calls for modern equipment. A 90 per cent extraction means little if power losses are high or if machinery is inefficient.

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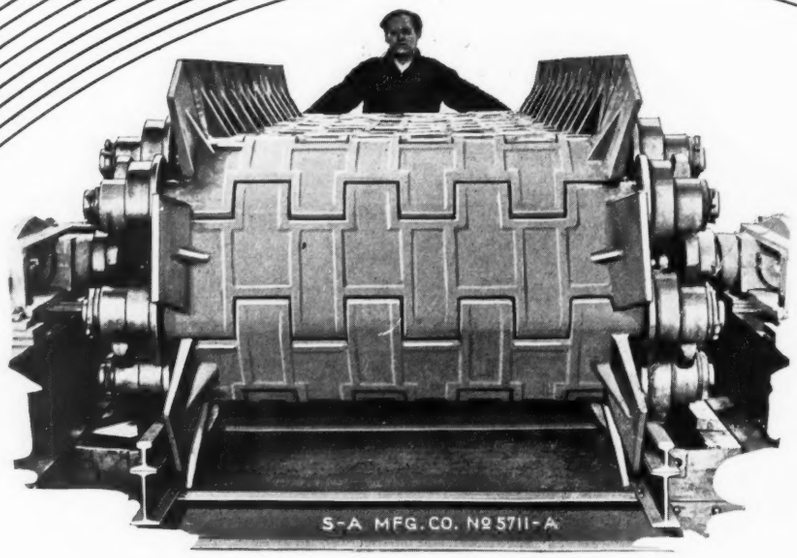

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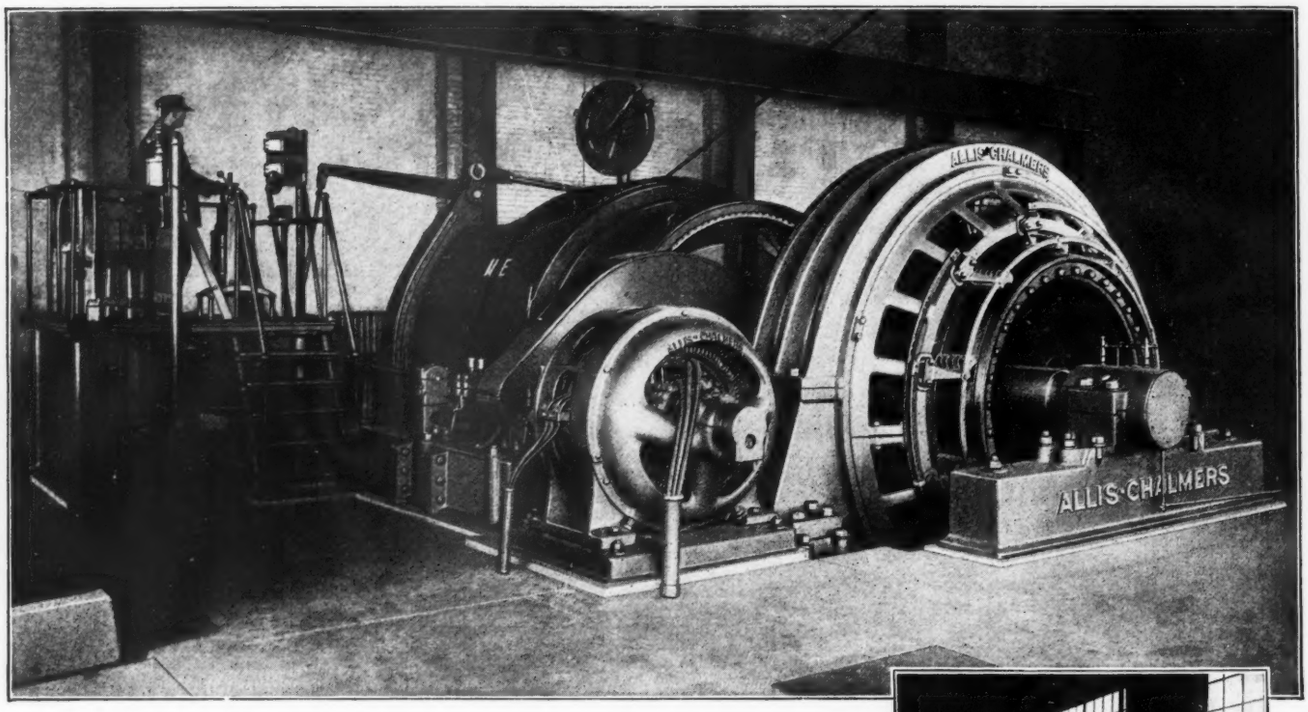

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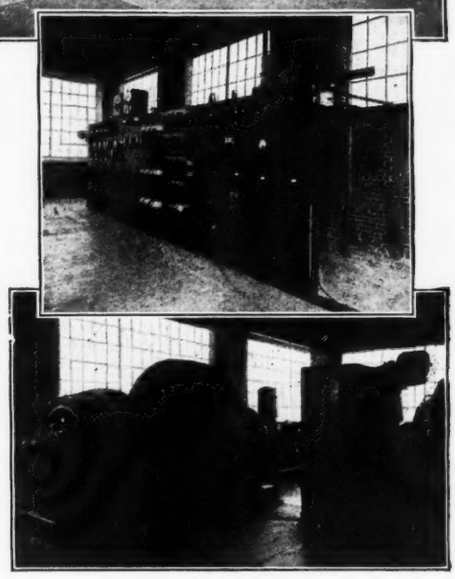
Complete Equipment **Undivided Responsibility**
All By One Builder.



Top—28,940 lbs. rope pull, 2,600 ft. per min. Balanced Cylindro-Conical Drum Hoist with 1,100 H.P., 72 R.P.M. Direct Connected Motor and 300 H.P. Auxiliary Motor.

Center—Switchboards and Control Panels.

Below—800 K.W. Flywheel Set with Liquid Starter and Automatic Slip Regulator.

Mechanical Data

Cage	15,000 Lbs.
Car	3,600 "
Coal	8,500 "
Rope	1,840 "
Small Dia. Drum	6-ft., 6-in.
Large Dia. Drum	11-ft., 6-in.
Drum Speed	72 R.P.M.

Parallel Motion Post Brakes Oil Operated.

Electrical Data

Main Motor	1,100 H.P.
Aux. A.C. Motor	300 H.P.
Flywheel Set	800 K.W.

Special D.C. Contactor Control
D.C. Motor Direct Connected
A.C. Motor Geared
Special Safety Interlocks
Liquid Regulator for Flywheel Set.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 121 | New York, March 13, 1926 | *Number* 11

Engineering and Mining Journal

WHEN the *Engineering and Mining Journal* and the *Mining and Scientific Press* became one, it seemed fitting that the union of two great mining papers should be represented prominently on the cover of the combined journals—hence the composite name *Engineering and Mining Journal-Press* was adopted as the designation. As time went on, however, the complaint came from many sources that the new designation was something more than a mouthful—that it was difficult to say it without taking a breath in the middle. Indeed, the staff of the journal, which represented and still represents the combined staffs of the two parent papers, were obliged to confess to the same difficulty. Outside the staff the ancient familiar shortening to *E. & M. J.* was not extended to *E. & M. J.-P.*, any more than the addition of Metallurgical to the name of the American Institute could alter the popular designation of it as the A. I. M. E.

Much thought was eventually focused on this problem. Evidently, a shorter name was preferable. Algernon William De Courcy Smith-Jones might go on a visiting card, but his friends still know him as Bill Jones. There was reluctance to drop the *Journal-Press* hyphenation. Therefore the idea of leaving off the "Engineering" was most seriously considered; and even leaving off both this and "Press," leaving the representative paper of the industry simply *The Mining Journal*. Within the last few months, however, a strong current of opinion among our subscribers against cancelling the old "Engineering and" cognomen became urgent. This led to a restricted personal canvass of opinion. Then, in order to gage opinion more exactly, 100 valued subscribers, widely scattered geographically, were picked out at random, and to them the following letter was sent:

"We have had many criticisms of the length of the present name of *Engineering and Mining Journal-Press*. In order to decide what we shall best do in the future, I have picked out a small selective list of subscribers on whose opinion I place weight and am writing them asking them in the future under which of the following names the paper should be known:

Engineering and Mining Journal-Press
The Mining Journal-Press
The Mining Journal
Engineering and Mining Journal

"If you have time for nothing else, would be glad if you would check the name which you prefer and mail the letter back to me. The vote which I receive will strongly influence our decision."

From these 100 letters we have 97 replies, from which we know that the other three are away on long field trips. The ballot tabulates as follows:

Engineering and Mining Journal, 54½; *The Mining Journal*, 27½; *The Mining Journal-Press*, 11; *Engineering and Mining Journal-Press*, 3; one man was noncommittal.

The vote was also broken down by geographical regions, to see whether, for example, there was a Western sentiment diverse from the Eastern one. There was not: the vote in proportion, for the different names, was surprisingly the same, on the west coast of the United States as on the east coast. This proves that there does not persist any sectionalism. For example, the vote for the name *Engineering and Mining Journal* tabulates as follows: Atlantic Coast region, 5; Middle States, 23; Rocky Mountain belt, 6½; Pacific Coast belt, 20. That for *The Mining Journal* thus: Atlantic Coast region, 3; Middle States, 6; Rocky Mountain belt, 6½; Pacific Coast belt, 12. That for *Mining Journal-Press*: Atlantic Coast region, 2; Middle States, 4; Rocky Mountain belt, 1; Pacific Coast belt, 4.

Approval of our present name, it will be seen, was almost totally absent; for the shorter designation, *The Mining Journal-Press*, considerable, and from good judges; of *The Mining Journal*, large; of *Engineering and Mining Journal*, preponderant.

In sum, were it not for *The Mining Journal*, of London, this designation would be seriously considered; but courtesy and our British circulation prohibit this. Therefore the decision seems inevitable, in our opinion (and in the *our* the opinion of Mr. Rickard is included), to revert to the name *Engineering and Mining Journal*. This will be done with the new volume, beginning July 1 of this year:

Below we give a few of the specific opinions received as a result of our canvass:

For *Engineering and Mining Journal:*

From C. B. Lakenan:

"All readers know the old *Engineering and Mining Journal* as the *E. & M. J.*, and as this name conveys the impression to a possible new subscriber that it is an issue dealing with engineering as well as the current developments in the mining world, I favor the old name—*Engineering and Mining Journal. The Mining Journal*, in my judgment, is not comprehensive enough, although a shorter name; and *The Mining Journal-Press* does not convey in sufficiently accurate heading that the issue deals with highly technical papers on various kindred subjects."

From Sidney J. Jennings:

"My main reason for preferring the name of *Engineering and Mining Journal* is that the *E. & M. J.* quotations for copper and silver are known throughout the mining region of the West, and are accepted without question by all miners with whom we have contact. This to us is one of the most favorable features of the *Journal*, and its value would be distinctly diminished if some other name were adopted which would not permit of the use of these initials to distinguish the quotations used."

From Philip N. Moore:

"Of the proposed names submitted in your list, I prefer the old name of *Engineering and Mining Journal*, largely because of old acquaintance, for I have been a subscriber more than fifty years, but also as covering a little broader field than pure mining. The term *Mining Journal* is apt to

savor of the little local periodicals which spring up from time to time in new mining camps. *The Mining Journal-Press* is not seriously objectionable, but, looking at it all round, I vote for my first choice."

From Will J. Penhallegon:

"Acknowledging receipt of yours of the 12th, it would have been very easy to check *Engineering and Mining Journal* and return your letter as requested, but having been a subscriber for many years previous to the consolidation, it has always been the *Engineering and Mining Journal* to me, and I doubt if any change in name could change the association. The *Engineering and Mining Journal* is the Mining Engineers' magazine, and I hope that it will not lose its identity."

From D. C. Jackling:

"Personally I would prefer to receive this publication under the old name, *Engineering and Mining Journal.* There may be, and doubtless are, however, reasons why you wish to perpetuate the word 'Press' as evidence of the absorption of the *Mining and Scientific Press.* If this is important, my suggestion would then be *Engineering and Mining Press* rather than any of the titles you propose, thus perpetuating the principal features of the title of the original *Engineering and Mining Journal* which has become a standard of engineering and mining discussions the world over. The words 'Engineering' and 'Mining' are, as I consider it, the ones that are most important in the title and that should be preserved. You know, of course, that this publication is named as a basis of metal-market quotations in pretty nearly every smelting contract in existence in North America. Doubtless any new title you adopt will continue to be similarly used, but I believe the majority of the engineering profession engaged in the mining industry would prefer to see the principal characteristics of the old title preserved."

For *Mining Journal:*

From S. J. Kidder:

"I have so frequently heard the *Journal* referred to as the *Mining Journal* both by engineers and others that it seems to me that this brief name would be most suitable and sufficiently comprehensive to cover the entire field of journalism covered by the *Engineering and Mining Journal-Press.*"

From Stanly A. Easton:

"The suggestion referred to in your letter of the 12th that the present name, *Engineering and Mining Journal-Press,* is unnecessarily long is agreed to by me. From the proposed names set out in your letter I prefer *Mining Journal;* in my judgment the word 'Engineering' is unnecessary, because mining *is* engineering. As the *Journal* is circulated internationally, my personal taste indicates some word in its title that would designate its true nationality; say such a title as the *American Mining Journal,* but this may not really be worth while."

From James F. McCarthy:

"I like short names, and of those you submitted my preference would be for *The Mining Journal.*"

For *Mining Journal-Press:*

From R. M. Raymond:

"I have pleasure in acknowledging your note of Jan. 12th, and in casting my vote for the title, *The Mining Journal-Press.* The present title is certainly cumbersome, whereas 'Mining' indicates 'Engineering,' and the combination of the *Journal-Press* indicates not only the combination of two magazines, but that you are publishing also books of real worth—not only the little short 'kinks,' but volumes which have added so much to the literature of the industry."

From J. Parke Channing:

"For a number of years I have thought that the word 'Engineering' was redundant and should be eliminated. Might it not be desirable to eliminate the word 'The' and just use the resultant name *Mining Journal-Press?*"

All good men and true, it will be observed; and a notable and most courteous response to the referendum which was sent out by the Editor. He herewith extends his thanks.

A Quarter Century of Steel

LAST WEEK saw the twenty-fifth anniversary of the organization of the United States Steel Corporation. The day, Feb. 25, was similarly the anniversary of Judge E. H. Gary's appointment as chief executive officer of the corporation, whose affairs he has guided from the beginning. When it was formed, the company seemed a colossal enterprise—and it was, when its capital is considered. It was the world's first "billion-dollar corporation," and in those days before the war a billion dollars was a sizable amount. The war taught us to think in hundreds of billions, and the depreciation of the mark and ruble that followed compelled the world to use figures of almost astronomical proportions.

In its first official balance sheet the corporation showed assets of more than one and one-half billions. Its latest statement—the balance sheet of Dec. 31, 1924—showed assets of over $2,414,000,000, and today they are valued at fully a billion dollars more than at the outset, this great increase being due to the policy of putting accumulated profits back into the business. In the past quarter century the capacity of the corporation has doubled and its plants are said to be able to produce 45 per cent of the country's output. Of the iron-ore tonnage shipped from the Lake Superior ranges in 1925, totaling 55,534,812 tons, the Steel Corporation's share was about 44½ per cent.

Rumor has it that Judge Gary is thinking of resigning during the present year. Since he is now almost eighty, this is not at all unlikely. Already Wall Street is talking of his successor. The corporation has prospered greatly under his guiding hand, but, organized as it is, it is improbable that its affairs will be much affected by a change in its executive head.

Profiting by Past Experience

THOSE ENGAGED in the mining industry will recall frequent cases of litigation with reference to injurious smelter smoke and damages due to mining operations, resulting in injunctions that caused much loss to the operator. In our Western states mining industries have grown up in various localities, and immediately upon the establishment of a permanent industry the agricultural element followed close behind and began cultivating the ground within the shadow of the smelter fumes. Smelter smoke in many cases damaged the crops that the farmers attempted to grow, with the result that the farmers instigated legal proceedings against the smelters, attempting to "kill the goose that laid the golden egg."

This trouble has been anticipated in a bill which is now before the Quebec Assembly providing for the appointment of a Commissioner of Mines having jurisdiction over the Rouyn district. This bill includes a provision that no person shall prevent or hinder, by means of an injunction or other legal proceedings, the operation of smelters, mines, or other works for treating ores. The recourse, if any, is to be confined to a claim for damages. It also provides that no owner, tenant, or occupant of land in the township of Rouyn and adjacent townships can claim damages on account of the harmful gases and smoke produced during the operation of a smelter erected in the Township of Rouyn on a site chosen or approved by the Lieutenant Governor

in Council, provided, however, that the plans and specifications for such smelter have been previously approved by the Commissioner of Mines. This provision is to apply to all lands already occupied, ceded, or patented in such township as mining land. With this provision on the statute books it will not be possible for agricultural interests in any way to hamper or hinder the operation of mining and smelting. There will be no chance for endless litigation. It is a wise step and for the best good of the industry.

The commissioner to be appointed will have almost unlimited powers in that he shall have jurisdiction to the exclusion of every other tribunal or court, with powers to examine, hear, and determine questions regarding any mining land, claim, license, or rights. The powers granted the mining commissioner in the matter of holding court are wide even to the extent of permitting him to engage experts to gather information and generally to have much the same powers as a judge of the superior court. Provision is made, however, for appeals to the King's Bench against judgments given by the commissioner, but appeal must be made within thirty days and security furnished as in other cases.

Dollar Bay and the Carson Patents

PETITION for retrial of the suit of George Campbell Carson against the American Smelting & Refining Co. for alleged infringement of his reverberatory furnace feeding patents has been denied by the Circuit Court of Appeals and an accounting has been ordered. In suits against the other companies, that are expected to follow, evidence unknown to the A. S. & R. Co. will be admissible and the outcome may be different.

Between 1903 and 1906, at the Dollar Bay plant in Michigan, several furnaces were constructed in the design of which were included round iron hoppers supported above the furnace and connected by chutes or troughs with not fewer than ten charge holes through the roof of the furnace near the vertical side walls.

Although the literature of reverberatory copper smelting has been carefully searched, the beginnings of the side-charging reverberatory are imperfectly recorded, which fact has been a distinct disadvantage to the copper-smelting industry in defending its contention that side-feeding was an industrial development rather than the invention of any one man. In our editorial study of the history of side-charging published in *Engineering and Mining Journal*, Nov. 26, 1921, p. 827, it is stated that the first description of the practice of side-charging was given by L. D. Ricketts in 1909-10. In it he states that the method originated in Cananea and was the result of suggestions made by Gmehling and Shelby. Many years prior to this, Siemens had invented and patented reverberatory furnaces in which side-charging of ore for the purpose of making steel was a feature of the furnace construction. His patents specifically included the use of similar furnaces for the smelting of copper ores. Most smelter men knew of the Cananea installation, but the fact that side-charging was a feature of reveberatory furnaces at Dollar Bay as early as 1903 is news and brings out the point that metallurgical history is only imperfectly recorded.

The increase in the dimensions of copper reverberatory smelting furnaces was gradual, but about the beginning of 1900 larger and larger furnaces of this type became common. The smaller furnaces could be satisfactorily operated by feed hoppers discharging at the center line of the reverberatory arch, but as the furnace was widened the inadequacy of this became apparent and side-charging was an obvious alternative, more especially as it gave an unbroken arch at the critical part of the furnace. Thus the change from center-line feed-hoppers to two lines of side feed-hoppers was developed in response to the practical experience of the smelters.

The need for recording accurately advances made in smelting practice is brought into considerable prominence by the Carson litigation, for if there had been published in the *Engineering and Mining Journal* of that time a complete record of the novelties developed in different plants, it is highly probable that this litigation would not have been started. *Mining Journal-Press* is a public record, that offers mining and smelter men an opportunity to fulfill an obligation to their industries.

Floodlights and Searchlights

DARKNESS has seemed as much the miner's lot as hunger the portion of the poor. So, since the day when man first crawled into a gopher hole and left the sun behind, he has taken it for granted that his work must be by flickering lamp or taper, casting its rays over but a far too limited area, or else by reflected daylight. After ages of such mole-like work, electricity appeared. Used at first to light only the stations, the crosscuts and principal haulageways, it gradually gained in favor as it demonstrated its worth and its practicability. Today the illumination of stopes is an accomplished fact. Such illumination is most easily effected by floodlights that can be moved about and placed wherever they will be of greatest value. Acetylene lights of high power are used at times where current is not available, but the electric floodlight is by far the most efficient and convenient. One important iron-ore operator adopted it to illuminate the company's stopes, which are often of considerable size. The first floodlight thus installed paid for itself almost immediately, the superintendent asserted, because its light revealed dangerous ground about to fall that otherwise would never have been detected owing to its height above the floor. It is likely that as the practice of floodlighting stopes becomes more common, accidents from falling rock will lessen.

Floodlights have their uses on the surface—at night—to illuminate the plant and the railroad yards; and in those open pits that are worked on double shift the searchlight is being used to good advantage. The huge pit of the Premier diamond mines, in the Transvaal, is equipped with searchlights to facilitate work at night. Oval in shape and about a half-mile long by a quarter wide and 500 ft. in depth, it is now satisfactorily illuminated by a new lighting scheme that uses a battery of fourteen projectors containing 1,500-watt or 2,000-watt tungsten lamps. The distances from the lamps to the surfaces illuminated range from 900 to 1,600 ft., and the light at the point of work is said to be excellently diffused and of sufficient volume. This is but an instance, though a spectacular one.

Adequate lighting of a working place improves results and lessens accidents, as any factory superintendent knows. What is true of factories in this respect is also true of mines. Besides, good lighting makes any work more pleasant.

Mining Engineers of Note

James W. Wade

THE TINTIC STANDARD MINE, largest producer of silver from essentially silver ores in the United States today, like other rich mines, has had its ups and downs. The situation in 1921 was not good. The mine was in bad physical condition, principally as a consequence of injudicious methods of mining and the efforts to keep up a higher rate of production than was warranted under prevailing conditions. Current development had been neglected and likewise development for future years. In this crisis, E. J. Raddatz, president and manager for the company, wanted the best man he could find to take charge of operations. He selected James W. Wade, the subject of this sketch. That his choice was a good one is attested by the remarkable success of the last four years, during which Mr. Wade, as assistant general manager, has had a free hand in conducting operations. Not only have the methods of extracting the ore been changed radically but the mine has been put in excellent condition, the complex and puzzling geological problems have been solved and immense reserves of ore have been developed. Moreover, by the adoption of close selective mining and negotiation of more suitable smelter contracts, the proceeds from the available ores have been augmented. The test of good mine management is not so much to make a satisfactory profit from a rich mine, but to make the maximum possible profit. Mr. Wade and his organization strive as hard to increase earnings as they would if the ore were low in grade and the goal were to keep from losing money, as is the problem at many mines. Ancestry, birth, early environment, natural inclination, education, force of circumstance and self-determination all contributed to making Mr. Wade essentially a miner. He was born at Kirby, England, of Scotch-English ancestors who for generations had been miners. As a baby he was brought to the United States, and his first impressions of mining were gained at the Union Pacific coal mine, in Wyoming, where his father was employed. Later he went to school in Salt Lake City, part of his early education being obtained by attending noon-hour classes in Latin and mathematics at the high school while employed in the general offices of the Oregon Short Line Railroad, which were in an adjoining building. When seventeen years old he went to work for the White Knob Copper Co. at Mackay, Idaho, and two years later entered the Utah School of Mines. Here he not only distinguished himself as a student, but was an important factor in putting Utah on the Rocky Mountain football map. For four years he was quarterback, and for two years captain, of the team. Upon graduation in 1905 he became a U. S. Deputy Mineral Surveyor and has been engaged in the practice of mining engineering ever since, his activities spreading over all of the western states from Montana to Arizona. Among the important undertakings he supervised were the making of maps and elaborate mine models of the Utah-Apex and Yampa workings in Bingham, Utah; and of the Mammoth and Grand Central mines in the Tintic district in connection with the litigation between these two famous mines. At different times between 1914 and 1918 he operated as a lessee several well-known old producers, including the Carbonate, Maxfield, and Scranton mines. Each of these operations returned a profit, although other people both before and since lost money in similar attempts. In 1918 Mr. Wade was appointed Captain of Engineers in the United States Army, but the armistice prevented his going overseas. Last year he was one of the committee of five that drew up the brief of the American Silver Producers' Association, opposing the revaluation of silver mines by the Treasury Department. In August, 1925, the Governor of Utah appointed him regent of the University of Utah, of which the School of Mines is a part. This was in recognition not alone of his reputation for integrity and sound judgment but because he enjoys in unusual degree the confidence of the alumni. "Jimmy" Wade, as every one knows him, is an example of a man who, starting life without wealth or influential connections of any kind, has risen through natural ability and force of character to success in his profession and to a position of high esteem in the community in which he grew up.

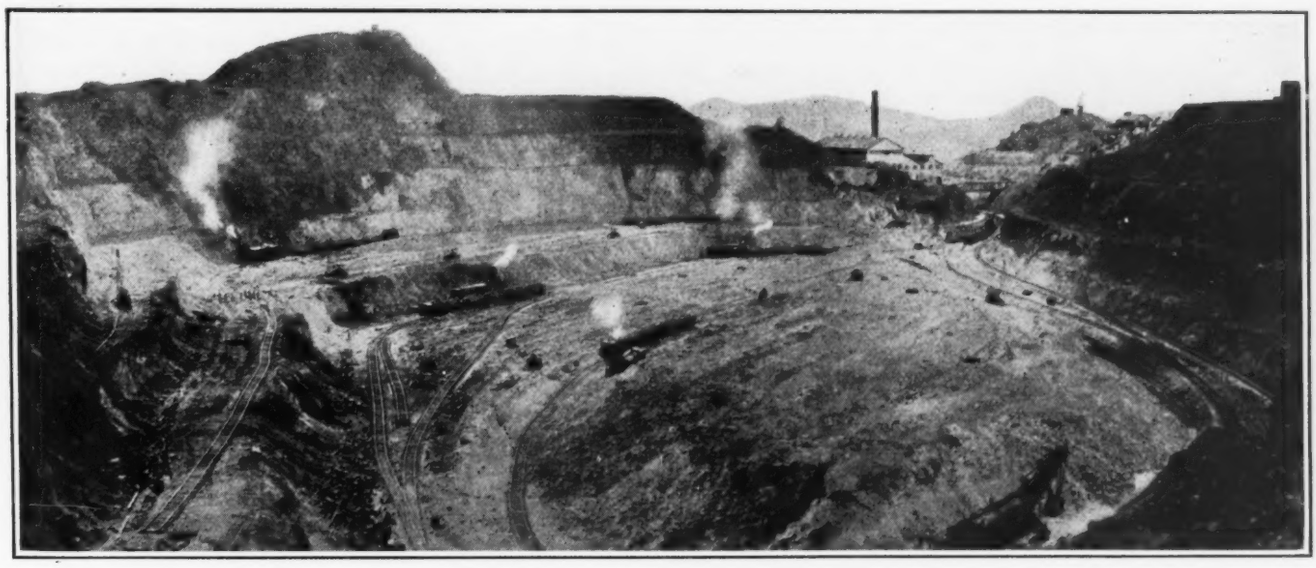
JAMES W. WADE

Methods of Mining Copper in Arizona—I

Up-to-Date Details of Those Now in Use in Working the Principal Lode and Porphyry Deposits of the Southwest—Steam Shoveling at Sacramento Hill

By George J. Young
Associate Editor

THROUGH THE CO-OPERATION of a number of mine superintendents and managers, much of the information in this article was gathered with the purpose in view of recording the present position of mining methods in use at Arizona copper mines. At three mines, the United Verde, the New Cornelia, and the Copper Queen, respectively at Jerome, Ajo, and Bisbee, open-pit mining is practised. Steam shovels are in use at all the open pits, which are of the bench type. Practice at Ajo and at Jerome has already been described.[1] At the United Verde the smaller steam shovels have been equipped with caterpillar tractors, but at both Bisbee and Ajo the steam shovel equipment has not been altered as far as I am aware, and is of the usual type.



Open pit at Sacramento Hill, Copper Queen mine, Bisbee, Ariz.

The Copper Queen branch of the Phelps Dodge Corporation operates an open pit on Sacramento Hill in addition to its group of contiguous mines at Bisbee. The open-pit operations produce, on the present restricted schedule, about 100,000 tons of ore per month, which is divided into three grades: mill ore, which goes to the concentrator at Warren; leaching ore, which is segregated into two classes and dumped respectively upon two leaching dumps in the vicinity of the concentrator, and high-grade smelting ore, which is sent to the Douglas smelter.

The open-pit benches are maintained at 30 ft. in height. Holes are drilled by churn drills, the spacing being 21 ft. apart and from 20 to 30 ft. back from the edge. Drilling equipment consists of seven churn drills. The number of drills in operation is varied in response to changing conditions. Where necessary, air drills are used to put in toe holes. Churn drills average 42 ft. per shift and air drills 41.9 ft. Explosives are varied to suit the ground, gelatin powder being used for wet holes, 40 per cent ammonia powder for hard ground, and Hercules black powder for soft ground, the respective quantities being 15, 60, and 25 per cent. The explosives ratio is about 0.55 lb. per ton. Holes are blasted in groups. More or less block-holing is done with hand-held drills. All churn-drill holes are drilled 5 ft. below the grade established by the bench.

Loading is effected by steam shovels, of which there are seven, all of the 88-C Bucyrus type, with 3½-yd. buckets. Oil fuel is used. Shovels are operated at present on day shift only. Part of the work is in stripping and part in ore, about equally divided. The output per shovel shift was 786 (solid) cu.yd. in 1923; 841 in 1924, and about 1,000 cu.yd. for the first half of 1925. Car equipment consists of twenty 25-cu.yd. Western Wheel Scraper air-dump cars. These are handled in trains of five cars each. Direct costs for open-pit work are around 29c. per ton moved. This includes transportation to waste dump, mill, or leaching piles. Open-pit operations are in charge of S. G. Plummer.

Arizona copper mines fall into two groups with respect to type of orebody: lode mines such as the Copper Queen group, the Calumet & Arizona group, United Verde, United Verde Extension, Magma, and the Old

[1] A. W. Allen, *Mining Journal-Press*, Vol. 114, p. 185. G. J. Young, *Mining Journal-Press*, Vol. 119, p. 357.

Dominion, at Globe; the porphyry group, which includes Inspiration, Miami, Ray, and Morenci. The methods in use at these mines will be described.

Copper Queen Group—At the Copper Queen, underground mining is restricted mostly to direct-smelting copper ores which average over 6 per cent copper, although some lower-grade porphyry ore is now being caved and sent to the concentrator. The orebodies are in limestone and are irregular in all dimensions, so that mining is selective. Three principal methods are in use: overhand and underhand stoping with square-set timbering, incline cut-and-fill, and top slicing. Square-set stopes are generally three sets wide by five sets long. Slides are used wherever possible to eliminate mucking. The labor ratio in square-set stopes is 5½ tons per man-shift, which includes all labor up to the chute. Cost of labor, timber, and explosives is about $1.87 per ton. The incline cut-and-fill stopes range from 15 to 20 ft. in width. Stoping follows the usual methods. The labor ratio is practically the same as for the square-set stopes, but the cost for labor, timber, and supplies is less, averaging $1.65 per ton.

Top slicing involves novel features. The sections or units are 50 ft. wide, the chute raises being spaced on 50-ft. centers in the middle of the panel. Slicers are 10 ft. in height. The plan and section of a unit is shown in Fig. 1. Chute raises are cribbed, a manway being alongside of each chute. The unit, in plan, is 28 by 50 ft. Square-set timbers are used; the center-to-center interval parallel with the room width is 7 ft. and the interval at right angles, 5 ft. An auxiliary gangway at right angles to the length of the room is opened out 11 ft. below the room floor and timbered with square sets spaced at 3½-ft. centers. The gangway, as shown in the plan, is placed with one side on the room axis. Chute raises and manways are at the side of the auxiliary drift. Ten-inch squared timbers are used. In mining the ore 25 per cent is delivered by slides directly to the chutes; 55 per cent is pulled by scraper directly to the chutes, and 20 per cent requires a double handling by the scraper. The arrangement avoids operating the scraper around right-angle turns. Labor output averages 6½ tons per man-shift in small stopes. Where large uniform orebodies are worked an output of ten tons per man-shift can be averaged. Labor, supplies, and timber cost $1.70 per ton.

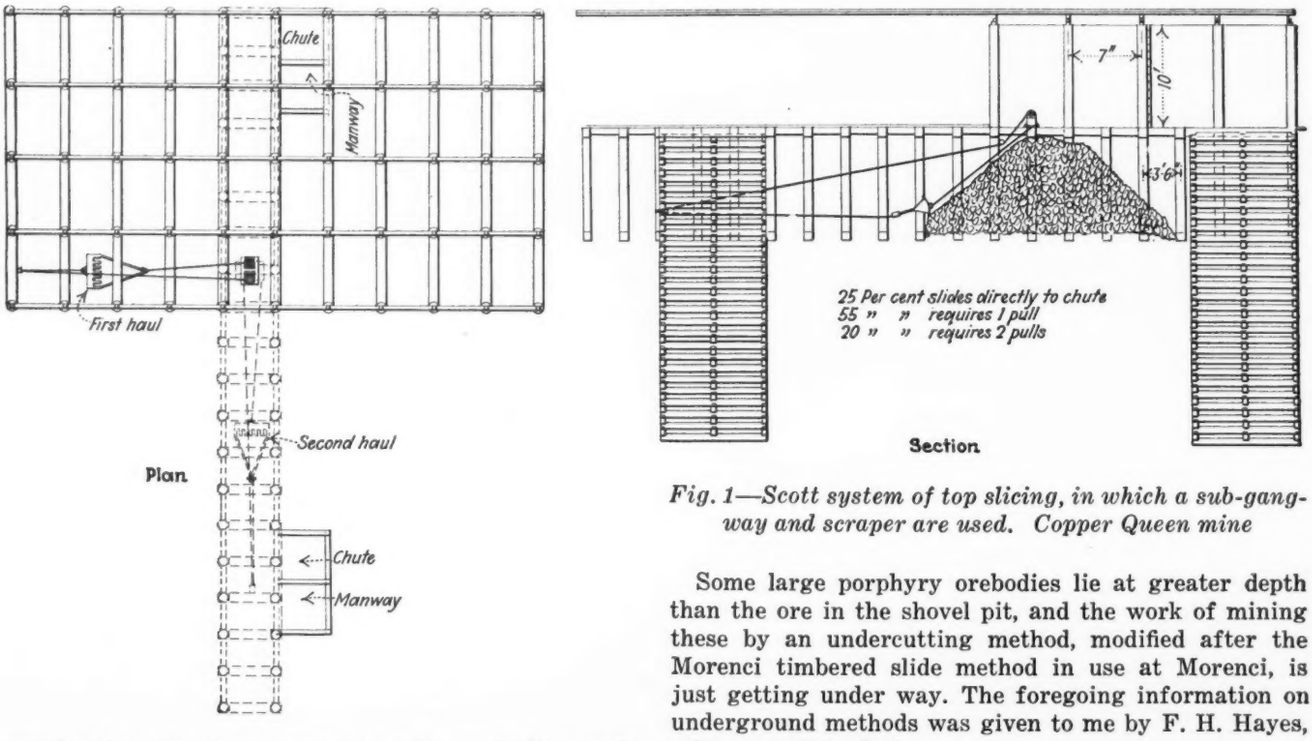


Fig. 1—Scott system of top slicing, in which a sub-gangway and scraper are used. Copper Queen mine

Some large porphyry orebodies lie at greater depth than the ore in the shovel pit, and the work of mining these by an undercutting method, modified after the Morenci timbered slide method in use at Morenci, is just getting under way. The foregoing information on underground methods was given to me by F. H. Hayes, mine superintendent.

Calumet & Arizona Group—At the Lowell and connecting mines of the Calumet & Arizona Mining Co., Lowell, Ariz., mining methods are practically restricted to two—incline cut-and-fill, or the Gilman method, and the Mitchell stoping method. Very little overhand stoping, with square-set timbering, is done, and that only for odd pieces of ground. Likewise, top slicing has been discarded. Top-slicing according to the Mitchell[2] method, which is a combination of a flat and inclined slice and which was applied in the area tributary to the Cole shaft, is of no importance now. The Briggs[3] underhand square-set method was devised to mine a soft, friable orebody, and is not now in use. Ratterree's modification of the Briggs underhand square-set method is also not now in use.

The Mitchell stoping method, which consists of underhand stoping a narrow pillar cut off by two narrow overhand, square-set stopes, is used to a considerable extent and has proved to be excellent practice. The Gilman cut-and-fill method is also of importance, but, as now applied, it has been improved in certain details. As originally described by Dickson, the waste-fill lagging between neighboring stopes was supported by vertical timbers, which were spliced to each other as the stope was carried upward. Experience with these proved that the splices would not hold, the vertical timbers would shift, and the lagging would pull off, spilling out the waste fill into the next stope. A line

[2]R. H. Dickson, *Engineering and Mining Journal*, Vol. 101; p. 631.

[3]*Mining Journal-Press*, Vol. 115; p. 5; 191.

of square sets is now used at the side of the stope to support the waste-fill lagging, and these are carried up with the stope. Stopes are about 60 ft. long and two stopes are carried up end to end with an offset and waste transfer between. Slices taken are from 9 to 10 ft. in thickness, the board floor being on a 40-deg. slope. The square sets on the side are constructed with 10-ft. caps parallel with the length of the stope, with posts at 5-ft. intervals and girts between. Space thus afforded at the side of the stope is of use in starting the next stope and is also used for chutes. The first stope in a given area is 30 ft. in width, but succeeding stopes are restricted to a width of 20 ft. Scrapers are used where the footwall of the orebody flattens out. Broken ore is drawn to the chutes and waste distributed by scrapers.

After a large area has been worked by incline cut-and-fill stopes, the remaining ore on the level is removed by Mitchell stopes. A Mitchell stope is started first with an overhand stope one set wide and five sets long and a similar stope on the end of a block four sets long. These are carried to the level above or to the top of the ore. The square-set caps, parallel with the length of the block, are 10 and sometimes 15 ft. in length, tying over one or two posts. The block of ore inclosed on two sides is 15 by 20 ft. in area, and the height of the ore or the distance between levels, 100 ft. At the top, the block is cut out, and the back is supported by heavy stringers, 10 by 12 in. by 15 ft. long, at 5-ft. centers. The uppermost stringer is reinforced by a three-piece truss (segment set), which is supported in part by the second stringer below (vertical spacing corresponds with square-set spacing or 7 ft. 10 in.). Stringers at the end of the block next to the filled and lagged stope are reinforced in a horizontal plane by a three-piece truss set. The block is mined downward by underhand stoping, additional stringers (10 by 10 in. in section) being placed at successive vertical spacings of 7 ft. 10 in. At the end of the block next to the end lead stope the last vertical line of stringers is sometimes omitted and the square sets are supported by a three-piece trussed set in a horizontal plane. The lead sets on the sides and ends of a block are used for ore passes. Timber grizzlies are put in place, and the cuts on the block are sloped so as to discharge the ore into the chutes. Slides are also used in the lead sets. On the completion of a block, the bottom and sides are lagged and waste filling is run in, about 60 per cent of the stringers being recovered, and in some instances practically all of them. No timber is recovered from the lead sets.

A block of ore 100 ft. in height can be won by the Mitchell stoping method. In some instances where the ore is heavy and shows signs of weakness the block is divided and the lower 50 ft. removed and filled first. The upper 50-ft. portion is then mined and likewise filled. The system is elastic and only 20 per cent of the volume is timbered permanently. It is lower in cost than overhand stoping with a square-set timbering.

Drilling in incline cut-and-fill stopes is with CC-11 Ingersoll-Rand stopers using 1-in. hollow hexagon steel. Waugh stopers, independent rotation, are also used with 1-in. hollow, round, lugged steel. Vertical holes are drilled in cut-and-fill stopes. Sullivan DX 61 drifters are used for development with 1¼-in. hollow round steel. To minimize dust the broken ore is wet down in the chutes. Ore is sometimes sprinkled down to avoid dust before it is sent to the chutes. Water is piped throughout the mine. Ventilation is effected by underground fans at the Briggs and Campbell shafts. Waste from

Surface subsidence at Humboldt mine, Morenci, Ariz. The large size of the blocks is due to the greater hardness of the rock in the capping

development is used for stope filling. Motor haulage is used on the even-numbered and mule haulage on the odd-numbered levels. Fred Sandtner, mine foreman, was kind enough to discuss these mining methods with me.

United Verde Mine—Methods in use at the United Verde have been described in an earlier article in the *Mining Journal-Press*. The principal orebody is massive

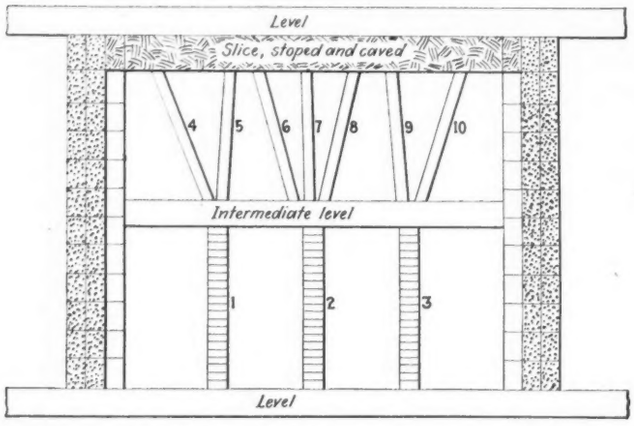


Fig. 2—Longitudinal section of a top-slice slope in the Old Dominion mine

pyrite and chalcopyrite, which is harder and tougher than the ore in other Arizona mines. It is mined by horizontal cut-and-fill stopes. Shrinkage stoping is applied in orebodies in the schist formation.

United Verde Extension—United Verde Extension Mining Co. employs overhand stoping with square-set timbering almost exclusively, the exception being a few stopes which are mined by the cut-and-fill method. Present practice is to mine stopes five to twenty sets long, two sets wide in extra heavy ground and three sets wide in good ground. Stopes four sets wide are not feasible except in rare cases. Heavy ground generally calls for the mining and filling of one floor at a time. In a few stopes, however, two floors are mined before filling. The fill is spread 1 ft. above the cap and ties to protect the timbers, and a double floor of 2-in. planks is laid. Stoping progresses in steps, one end of the stope being filled while the other end is producing.

Underhand square setting is resorted to very successfully in a few cases where the ground is badly broken up, especially where large blocks have broken away from the cap rock and have crushed. The caps and ties of the set on the floor above are supported by 8x10-in. booms while the ground is being taken out from the set on the mining floor. Several floors are mined this way before fill is introduced; in some instances the entire block, from capping to level below, is taken out in one operation, and then the whole stope is filled with waste.

Formerly a few stopes were worked from contact to contact—that is, clear across the orebody. This resulted in the stopes becoming heavy, with danger of possible caving. At present the stopes are vertically extended in smaller sections with greater speed and safety. Acknowledgment is made to George Kingdon, manager, for the foregoing information.

Magma Mine—Underground practice at the Magma mine, Superior, Ariz., has been described by W. C. Browning and F. W. Snow.[4] The lode dips at a steep angle, varying in width but averaging around 20 ft. As a rule it is removed in lifts of 100 ft., but in some cases a 200-ft. lift has been mined. Two methods are in use: one a timbered rill stope with square-set timbering, and the other a modification of the Mitchell stope. In the former, where the vein is 10 ft. wide, a stope 60 ft. long is carried and where 15 ft. or more in width, the stoping length is restricted to 30 ft. The back is carried in steps, waste filling being used. A given stope is started from a raise, and subsequent stopes make use of the ore pass of the worked-out stope as a waste pass for the new block. Where the Mitchell stope is used the orebody is blocked out in 15-ft. sections, alternate sections being mined as rill stopes. Pillars between are worked from the top down, segment sets and stringers being used to support the lagging placed with the fill in the rill stopes. Scrapers are used on the sill floor of the rill stopes.

Old Dominion Mine—The Old Dominion lode at Globe is a mineralized fault fissure, the downthrow on the south or hanging-wall side being 600 ft. The faulted series of formations consists of limestones, quartzites with massive intrusions of diabase, basalt flow, Cambrian limestone underlain by quartzites, shales, and conglomerates, and, last in the series, a crystalline schist. Mining is made difficult by heavy flows of water. The variety in formations and the fact that the lode occupies a fault fissure have influenced mining methods. Development is usually in the footwall, and crosscuts are extended to the lode. Three methods are in use: incline cut-and-fill, overhand stoping with square-set timbering, and top slicing. Top slicing is used in the widest parts of the vein and incline cut-and-fill in the narrow portions. Square sets are used in irregular flat orebodies in limestone. About two-thirds of the production is made by top slicing and one-third by the two other methods.

Main haulage levels are 200 ft. apart and intermediates are placed between. Principal development is in the footwall, the orebodies being reached by crosscuts. The vein dips at 70 deg. but flattens out in certain places. Top slicing is applied in the wider portions of the orebodies in the east end. The method is novel and interesting. A block 100 ft. in length is cut out by square-set stopes on each end. These stopes are three sets wide across the vein and extend from level to level (Fig. 2). Their purpose is to provide access and to prospect and sample the vein across its width. A timbered drift connects the two stopes on the footwall and crosscuts connect with the main drift. A sublevel is driven through the 100-ft. block, 43 ft. above the footwall drift. A working raise connects the sublevel with the lower drift at the middle of the block. From the sublevel small single-compartment raises 4 by 4 ft. in section are driven up to the first top-slicing floor. These are cribbed (3 by 3 ft. inside) where necessary and are numerous enough to serve the bottom of the top slicing floor. They are in effect finger raises. When a block of ground is ready for top slicing, the square-set sections at the ends are filled, with the exception of manway and chute at each end of the block. The top-slicing floors are 9 ft. in height, timbered with round posts. Stringers 5 by 8 in. by 10 to 12 ft. in length are used, and flooring consists of 2x12 in. by 10- to 12-ft. planks. The stringers are placed alongside of the posts and the flooring is laid on the completion of a slice. Broken ore is shoveled

[4] *Mining Journal-Press*, Vol. 119, p. 197.

into the finger raises which connect on the sublevel with the raises from the lower drift. The finger raises are left full of broken ore on the completion of a slice so as to prevent the breaking of sills and the timber mat from getting into the raise. Boards are nailed across the raises at the sublevel. The slicing unit is caved on completion and another slice started. The lower half of a block is mined from the footwall drift in a similar manner. Output in top slicing varies with the width of the slice and the hardness of the ore. Where the width ranges from 15 to 20 ft. production is from eight to nine tons per man-shift. In wider slices the output increases up to twelve to fifteen tons per man-shift. A single slice is worked at one time, but sometimes other slices are started before the first is finished. Occasionally as many as three slices are simultaneously worked. The longer the time given for the mat to settle the easier it is to hold on the next floor. As a consequence, a certain time interval is allowed to elapse before the next slice is started. The avoidance of loading in the slices and the use of finger raises for the disposal of the ore are unusual in top slicing. I. H. Barkdall, mine superintendent, says that the method has been in use for ten years.

Overhand stoping with square-set timbering and filling is used in the western part of the mine, where a considerable quantity of water occurs in the formations. The orebodies are irregular and are in limestone. Stopes are 15 ft. wide and 30 ft. long from hanging wall to footwall. The unit farthest distant from the tramming raise is first started, and successive blocks retreat toward the raise. The units are mined up to the level above, or 100 ft. in height. Ore that works out into the limestone is followed. As these extensions are flat, they are timbered with stulls.

Incline cut-and-fill or rill stoping is resorted to where wall rocks are hard. This method is used for vein widths up to 20 ft. Average width of several stopes is 14 ft. The back is carried at an angle varying from 43 to 45 deg. Length of the stope is not especially restricted. Ore is broken down upon inclined floors supported on waste fills. CC-11 and No. 73 Waugh stopers (water tube) are used in the stopes.

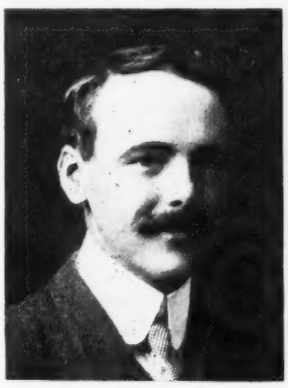
Ore passes are cribbed and lined with a single layer of 3-in. plank. A type of chute gate similar to the United Verde gate is in use. Arc gates are used on shaft pockets. Transfer raises are placed in hard rock where possible and are constructed as a two-compartment cribbed raise. When completed the cribbing is removed. The completed transfer is 5 by 9 ft. and is equipped with two gates. Scrapers and inclined steel plates have been used for loading in sublevels, but are unimportant. Small compressed-air-operated fans of the Waugh type for ventilation in stopes are being tried out and have proved to be more satisfactory than the resort to compressed air. Miners prefer the fans, which are cheap and portable, to air-hose ventilation. Mine ventilation is effected by large Sturtevant fans at the surface.

Acknowledgment is made to I. H. Barkdall, mine superintendent, who discussed the practice with me.

(To be continued)

Developing a China Clay Deposit in Ontario

By H. Sydney Hancock, Jr.
Fort William, Ont., Canada



H. S. Hancock, Jr.

A DEPOSIT of china clay of unusual purity is being developed on the east bank of the Mattagami River, about 60 miles north of Moonbeam Station, on the Canadian National Railways, and 32 miles northwesterly from the present end of steel of the Timiskaming and Northern Ontario Railway. The property comprises an area of about 400 acres with a frontage of more than one mile on the Mattagami River, from which the land slopes steeply back to an elevation of about 150 ft. above the water level of the stream.

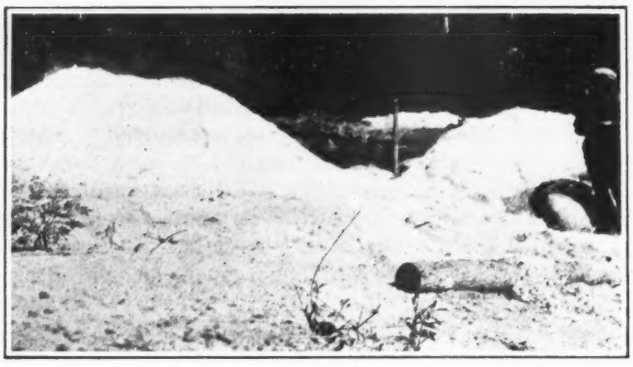
In 1916, C. M. McCarthy, of Elk Lake, the discoverer, while returning from a recruiting expedition to Moose Factory, noticed the outcroppings of colored fireclay along the river bank at this point. On landing to investigate, he discovered an underlying clay of exceptional whiteness, samples of which, on test, proved to be china clay or kaolin. Subsequently, he became associated with William Douglas, of Toronto, and together they have developed it up to the present time.

The overburden varies from 2 to 12 ft. in thickness, with an average of between 4 and 5 ft.; and, although it has been tested to a depth of 360 ft., there is no sign of reaching the bottom of the uniform formation of china clay and silica sand.

Generally speaking, the deposit, kaolin and sand, is overlaid by a covering of dense, plastic fireclay of varying colors, and of from 1 to 4 ft. in thickness, above which there is a coarse sand, which merges into the silt and loam of the top soil. No boulders or rocks have been encountered in pits or borings, nor are any to be seen on the surface of the property.

The deposit itself consists entirely of a high-grade kaolin intermingled with a quartz sand that is, practically speaking, pure silica, with a few infrequent pebbles of from pea to hazel-nut size that are either unchanged feldspar or quartz; and absolutely nothing else. This condition of remarkable purity suggests that the feldspar of the original rock must have been hydrated *in situ*, which is further borne out by the physical character of the kaolin in the globular manner in which it is associated with the sand, bearing a striking similarity to the Cornish kaolins, which were certainly so formed, in their granite matrix.

Viewing all the evidence I am convinced that this deposit was formed *in situ* from a massive intrusion of one of the rocks containing only feldspar and quartz, which, in the circumstance, may have been a proportionately constituted pegmatite or quartz-porphyry. It



Piles of kaolin. The whiteness suggests the purity of the deposit

is also probable that this mass was intrusive to the Devonian, which is the exact condition that contributed to the kaolinization of the feldspar in the granites of the Cornish formation.

The completeness of the kaolinization indicates hydration over a very long period, beginning long before the Glacial period, and the escape of the deposit from glacial erosion may be attributed to the amphitheater-like escarpment of Pre-Cambrian rocks that encircles its southern boundary. The dense fireclay with which it is covered has materially assisted in its hydration and the thermal waters or heated, chemically active gases ascending from below have accomplished this result during the Post-Glacial period.

However, by whatever process it has been achieved, the fact remains that here exists a vast deposit. In the Cornish deposits it takes from five to seven tons of the clay ground to produce one ton of merchantable china clay, the remainder being wasted in the huge "tips" that form such a striking feature of the landscape. In this case it is not possible to make an accurate estimate of respective proportions of china clay and the silica sand, but, from several experiments, I am sure that I am conservative in assuming that parts of the deposit contain 30 per cent of china clay, the remainder being pure silica sand that is of at least equal value per ton.

The china clay on this property is free from impurities and compares favorably with the best samples from existing sources of supply from the Cornish mines or any other. Its analysis shows a high content of silica and alumina, with a very small proportion of ferric oxide and only a trace of lime and magnesia. Combined with the china clay is a silica sand which gives a silica content of 99.1, alumina 0.324 per cent, and iron 0.176 per cent.

Covering it all is a fireclay of a high character. It was described in the summary report of the Mines Branch of Ontario of 1918 by the late Professor Joseph Keele as "the most refractory fireclay yet found in Canada." Within a few miles of the property is a deposit of coal of a semi-bituminous character which has a long flame on combustion.

Available within 300 yd. of the property is a water power, at the foot of the Long Rapids, having a fall of 208 ft. in a distance of 3½ miles and estimated to furnish 57,000 hp. at a minimum flow.

The Ontario Provincial Government has expressed its intention of extending the Timiskaming & Northern Ontario Railway to the deposit as soon as active development begins.

How to Sample Clay Deposits

The Canadian Department of Mines has recently issued a memorandum describing the work of the Ceramic Testing and Research Laboratories at Ottawa. The bulletin gives practical instructions as to clay sampling:

"Many people send a few ounces of clay to a testing laboratory and expect to be told all about its properties and uses. At least five pounds of clay should be submitted, and even then the testing is only preliminary.

"Few clay or shale deposits are uniform in character throughout their entire thickness, and the selection of samples for testing is, therefore, a matter of some importance. If the deposit appears to be uniform the sample should represent an average of the depth of the face it is proposed to work. The average sample should be supplemented by two or three other samples taken from different depths, as appearances are in many cases misleading in clay investigation. Many persons pick a small sample of clay from the surface of a deposit and send it to be tested. Tests on such samples are mostly useless. The body of material, when opened up for working, may give results entirely different from the thin veneer of weathered clay overlying it. In a locality where industries have been for a long time working satisfactorily on a widespread material and one uniform in character, the necessary information may be obtained merely by inspection of a suitable site in the vicinity of the older plants. This proceeding is often, but not always, safe where the manufacturer of common brick only is concerned. Where any of the highest class of clay products are to be made, the cheapest method is to take every possible precaution at the outset.

"A method of sampling shale and clay deposits has been approved and published by the Committee on Standards of the American Ceramic Society."

Lighting a Diamond Mine in South Africa

Work in the Premier mines in Transvaal, South Africa, from which the record-breaking Cullinan diamond was taken some years ago, continues day and night, and it is therefore essential that the huge area be adequately illuminated at night. This has recently been accomplished by the installation of a unique battery of incandescent searchlights, replacing the arc lighting system first used. Equipment and engineering assistance were secured from the South African General Electric Co. for the new lighting system.

Fourteen huts have been placed around the rim of the pipe, and in each is a battery of projectors containing 1,500-watt or 2,000-watt lamps with monoplane-type filaments. Each projector has a 16-in. parabolic mirror, and in front of the lamp is 5¼-in. spherical mirror. Current for lighting the mines and works is distributed by four substations from a generating plant that contains a 1,500-kw., three-phase turbine-generator set, a 750-kw., three-phase engine set, two 350-kw., three-phase engine sets and three 350-kw. direct-current engine sets. The distances from the projectors to the surfaces illuminated range from 900 ft. to 1,600 ft., and the illumination at the point of work is excellently diffused and of satisfactory volume. The economy and flexibility of the incandescent lighting presents a marked improvement over the previous arc searchlights.

It is said that there had been removed from the Premier mines, up to near the end of 1924, 102,500,000 loads of ground and that from this have been extracted 23,500,000 karats of diamonds.

Bauxite on the Gold Coast

Commercial Exploitation of Large Deposits of Aluminum Ore Awaits Transportation Facilities—Much of the Tonnage of Good Metal Grade

By Lloyd T. Emory
Consulting Engineer, 4 South 15th St., Philadelphia, Pa.

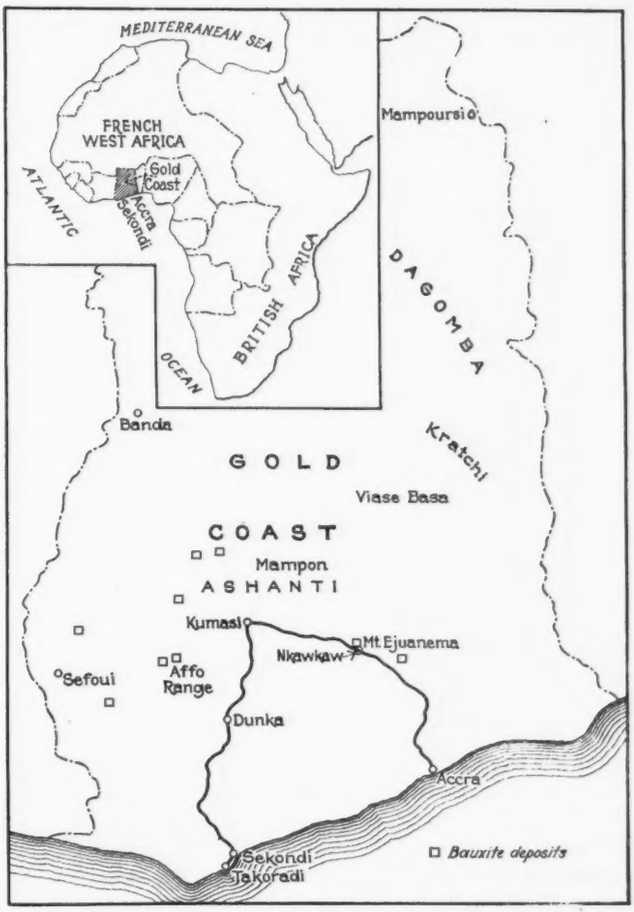
THE WEST COAST OF AFRICA, from the southern border of the Sahara Desert southward to the mouth of the Niger River, has for centuries been known as the Guinea Coast. It was from gold, brought from here by the Royal African Company, that the English gold coins valued at twenty-one shillings and familiarly known as the "guinea" were first struck. The Guinea Coast in turn was divided into the Grain Coast (now Sierra Leone), the Ivory Coast, the Gold Coast, and the Slave Coast (now Dahomey and part of Nigeria), according to the chief products of export. Europe's trade with this still undeveloped country extends far back into history. Herodotus (490-420 B. C.) describes the "silent trade" of the early Carthaginians who sailed past the Pillars of Hercules and braved the dangers of the open sea to exchange merchandise for native products. They left their wares on the open beach, where the natives came and exchanged for them gold, ivory, and forest products.

The Gold Coast, which comprises the Gold Coast Colony, Ashanti, the Northern Territories, and the British Mandate of Togo, contains 91,690 square miles with a coast line 334 miles long[1]. The shore line consists of a low, sandy foreshore. The headlands are marked by rocky cliffs rising several hundred feet, but most of the coast, which is very regular, is a strip of sand dunes backed by brackish and fresh water lagoons into which the rivers and streams empty. It is only during the rainy season that they are able to force the barrier of drifting sand and flow directly into the sea. Natural harbors are non-existent, and with one exception, which will be mentioned later, ships lie in the open sea and load from lighters—a dangerous and an expensive method.

Traveling inland, one encounters a scrub-covered plain, which varies from a few miles in width near Sekondi (Seccondee) to fifty miles near the eastern frontier. Then the "rain forest," consisting of broken country covered with dense tropical jungles through which the larger trees with wide-spreading branches force their way to a height of 200 ft. This dense growth prevents erosion, but together with the warmth and moisture hastens the decay of both fallen timber and the underlying rocks, and adds very materially to the difficulty of prospecting. The forest area extending for over 200 miles finally gives way to a more or less open upland country. The main drainage, which concentrates, except along the coast, in the Volta River, flows in a southerly direction to the sea.

Under British Rule

The type and density of population, estimated at 2,296,400, vary with the topographic characteristics of the country. The forest belt in the past proved a sanctuary for the native blacks of the tribe of Twi, who were forced down from the open country in the north by the Arabs and in from the coast on the south by the slave traders, and it was held successively by Portuguese, Danes, Dutch, and English. Since the British came into possession early in the eighteenth century there have been a number of wars with the native chiefs, the last occurring in 1900. With the exception of the part



Sketch map of Gold Coast Colony, showing situation of deposits of bauxite indicated by squares

taken by the colony during the World War, when it captured its neighbor, Togoland, from the Germans, there have been twenty-five years of peace. From the loyalty and enthusiasm shown by the native chiefs during the visit of the Prince of Wales a little less than a year ago, one would judge that there is little probability of trouble in the future[2]. Today, the government is that of a British Crown Colony, but the governments of the native tribes in the interior still control local affairs. Ashanti has a central native authority constituted in a king. The Northern Territories constitute a protectorate over what is left of the three native kingdoms, Dafomba, Moshi, and Mamprussi.

[1]From the Gold Coast Handbook for 1923.

[2]"The Prince at Accra," London *Times*, April 13, 1925.

Mount Ejuanema, on Kwahu plateau, where bauxite was first discovered in Gold Coast Colony

Accra, a coast town, is the seat of the British Government and the residence of the Governor, who is a single and supreme authority in the colony.

Gold has long been a product of export from the Gold Coast. Quite recently manganese, tin, bauxite, oil, and diamonds have been discovered by the Geological Survey Department, which is making a systematic study of the interior.

The principal deposit of manganese was discovered by the Geological Survey in 1914.[3] Owing to the stimulation of war demand, production reached 31,340 tons by 1918. The amount exported in 1924 was 233,401 tons and will probably reach 330,000 tons in 1925[4].

Ore First Reported in 1916

Bauxite, a hydrated oxide of aluminum and the principal ore from which the metal is derived, was first reported by A. E. Kitson, the director, in the Annual Report of the Gold Coast Geological Survey for 1916. Since then, each annual report contains additional data, which have been supplemented by lectures and magazine articles by Mr. Kitson. The most important deposits are situated in two rather widely separated districts of the forest belt,—namely, on Mount Ejuanema, in the Eastern Province, and in the Affo range, in the Western Province. It is quite possible that closer field work will disclose that the two lie in the same zone and are more or less connected by deposits of less importance unless erosion has cut the country below the elevation at which the deposits might be expected.

Mount Ejuanema (Uanema) rises from the Kwahu plateau, in the Wahu district of the Eastern Province. The nearest town of importance is Mpraeso. The deposit is about one and a half miles from, and 1,600 ft. above, the railway station at Nkawkaw, on the Accra-Kumasi Railway, and 111 miles from the Port of Accra. Accra is, however, a port without a harbor. Ships are loaded at sea from lighters. A small breakwater and a dock fitted with cranes facilitate the loading of the lighters at the shore. In all probability it will be found cheaper at present to haul the ore the long way around through Kumasi (Comassie), a distance of at least 250 miles, to Takoradi, near Sekondi (Seccondee), where new harbor works to protect ships lying alongside a dock were completed last April.

The deposit of bauxite rests as a cap on the flat top of Mount Ejuanema, which rises to an altitude of 2,520 ft. above sea level and 1,000 ft. above the Kwahu plateau. The summit of the mountain is about a mile long and a fourth of a mile wide at its widest point.

Country rock underlying the bauxite is composed of clay shales, mudstones, sandy shales, and sandstones of the Volta series. From their relation to other formations they are probably of Carboniferous age, but no identifying fossils have been found. They have a vertical thickness of about 800 ft. and rest on a base of igneous rock.

The ore, which is composed of massive and rubbly bauxite, has an average thickness of 23 ft. Its origin, according to Mr. Kitson, is the clay shales which by the natural abstraction of silica have been converted from the hydrated silicate into the hydrated oxide. Mr. Kitson believes this process still in progress and describes the base of the deposit as follows[5]:

"From observations of the base of the deposit it appears as if bauxitization of the clay is still in operation. Elongated pieces of yellow bauxite occurring in the clay show definite or indefinite tubes, along which water charged with dissolving agents is percolating downward, decomposing the clay, bearing away the silica and leaving the alumina. This action is inferred from the occurrence of these tubes in various stages of formation—the simple tubes lined with a thin film of bauxite; the thicker tubes and rods, several inches long and up to two inches thick, trending downward into the unaltered clay; the nodules of bauxite, ranging in size to above that of an orange, associated with coarsely granular bauxite dispersed through the clay; the more or less completely granular and rubbly bauxite, with odd pieces of ferriferous shale still showing its banded character, but partly or almost wholly converted into bauxite. These nodules and tubes are in the main much less ferriferous than is the rubbly bauxite. Many of them, especially the latter, are of bauxite of high grade.

"The dissolving agent or at least one of them appears to be carbon dioxide—perhaps humic acid in addition—derived probably from decaying vegetation. In the lowest portions of some of the shafts carbon dioxide was found to be present in the air in proportions so high that the light of candles lowered into the shaft was extinguished instantly on reaching depths ranging from 5 to 15 ft. from the bottoms of the shafts. The careful investigation of this matter has not been practicable."

During the World War the deposit was made a government reserve, which probably accounts for the large amount of development work the Survey has done at this location. Sixty-five test pits varying from 19 to 31 ft. deep have been sunk and three trenches from 40 to 75 ft. long dug on the flat top of the mountain. The

[3]Lecture by A. E. Kitson, Director of the Gold Coast Geological Survey, London, Nov. 4, 1924.

[4]"Outlines of the Mineral and Water-Power Resources of the Gold Coast." By A. E. Kitson, Director of the Gold Coast Geological Survey, October, 1925.

[5]"The Outlines of the Mineral and Water-Power Resources of the Gold Coast," 1925, page 21. By A. E. Kitson.

Broken massive bauxite from a shaft on summit of Mount Ejuanema

slopes of the mountain have been prospected with sixty-eight pits from 3 to 15 ft. deep. The thin overburden, which consists of red soil and pebble bauxite, varies from practically nothing up to 9 ft. in thickness.

An average of seventeen analyses of typical samples taken by the survey is as follows[6]:

	Per Cent
Alumina	60.55
Iron oxide	9.75
Silica	1.42
Titanium oxide	2.21
Lime and magnesia	0.73
Water of crystallization	25.59

The ore contains also about 0.03 per cent vanadium. One of the interesting features of the development work was the fact that many of the pits quickly filled with bad air, assumed to be carbon dioxide, soon after being excavated. The source of the gas was not discovered, but it seemed to filter out from the pores and crevices in the bauxite[7]. I have noticed similar phenomenon in other tropical countries.

According to a survey estimate, there is 4,359,000 tons of ore in the deposit, and from the published analysis one may judge that it is of good metal grade. Under present working conditions, however, the cost of transporting the ore to the coast would prevent it from being exported on a competitive basis with ore from other parts of the world. Limestone in quantity has been reported near Okraji, 20 miles distant, so the immediate utilization of the deposit may lie in the direction of manufacturing high alumina cement.

Several Deposits in Affo Range

The deposits considered of next importance are those of the Affo Range near Sefwi Bekwai, 50 miles northwest from Dunkwa, a station on the Sekondi-Kumasi Railway. Dunkwa is 100 miles from the coastal terminus of the railway, and there is a motor road connecting it with Wiawso which passes through Sefwi Bekwai. The deposits are about five miles from the latter place. Deposits of ore cap six high hills or peaks of the range, the most important of which is Mount Ichinniso, although Mount Supirri is usually mentioned in connection with the deposits, probably because the ore there was first developed[8].

The bauxite has apparently been derived from the weathering of the phyllites and fine-grained mica schists of which the tops of the hills are composed, by the leaching out of the silica. Patches of the original rock, both unaltered and in various stages of alteration, are included in the orebody. The quartz veins which traverse the country rock are traceable as thin bands and patches where the alteration has not been complete.

1—Seventy-five-foot trench on summit of Mount Ejuanema, showing massive bauxite in place. 2—A 40-ft. trench at another point on Mount Ejuanema. The surface material is composed of red soil and rubbly bauxite. 3—Members of the Geological Survey Expedition and a 50-ft. trench in bauxite

Poorer in Quality But Tonnage Large

One of the other interesting features of these deposits is that certain portions of them carry gold and silver in appreciable quantities. It is probably detrital gold from the weathering of the quartz veins, as it shows little or no evidence of attrition. The ore has neither the uniformity of grade or thickness of the Mount Ejuanema deposits, but, owing to the enormous tonnage available, the deposits will undoubtedly be of commercial importance in the future, when better transportation facilities are provided. Mr. Kitson estimates that there is more than 22,000,000 tons of ore that will average over 55.77 per cent alumina and less than 1.88 per cent silica[9].

A number of other deposits are reported, but they are all further from the railway and none on water

[6]Annual Report of the Gold Coast Geological Survey for 1919.

[7]From a personal discussion with Dr. E. O. Teale, assistant director, London, March, 1925.

[8]Annual Report of the Gold Coast Geological Survey, 1921.

[9]Outlines of the Mineral and Water-Power Resources of the Gold Coast, page 31, 1925.

transportation in reach of the coast. Two mountains 13 and 15 miles east-northeast of the Affo group have caps of ore estimated to contain at 925,000 and 200,000 tons. Mount Kawkawti, 18 miles west-northwest, is composed of a basic rock, probably dolerite, which has a cap of bauxitic laterite. Mount Tiffi, in the Yenahin district, 35 miles west and a little north of Kumasi, has a cap of ferriferous bauxite estimated at 7,000,000 tons.

Economic development of any mineral deposit is dependent on two factors—transportation and labor. The transportation situation has already been covered. While the native population average 18.79 per square mile, it is largely agricultural and not trained to work for wages. Latest census returns give only 13,400 out of a total of 2,296,400 as engaged in mining, which probably refers to gold and manganese. The supply of trained labor therefore seems limited. Common labor receives 30 to 60c. per day, and skilled labor from 60c. to $1.68.

Though the climate is tropical and rains are heavy, keeping in good health, so far as Europeans are concerned, depends largely on the ability to adjust living to local conditions and observance of the rules of modern sanitation.

Leaching Copper Tailings in Australia

The Moonta Copper Recovery Co., Ltd., started productive operations at the beginning of February, 1925, and the leaching of the old tailing heaps at Moonta Mines, South Australia, has since been carried on continuously, says a report of the South Australian Inspector of Mines, J. L. Pearson. Production to June 30 amounted to 156.65 tons of precipitate, averaging about 78 per cent copper. Twenty-four men are employed by the company.

So far, operations have been confined to the treatment of the coarser material, which amounts to about 1,400,000 tons distributed in five heaps of tailings which range from 30 to 60 ft. in height and cover a total area of approximately twenty acres. The surface of these is divided into irrigation furrows.

From exposure to air and moisture the copper sulphides in the tailings are slowly converted into soluble sulphates, and the different sections are treated in rotation after intervals, allowing time for the oxidation of the mineral contents. The leaching liquors are distributed over the surface of the heaps through a system of wood-lined cast-iron pipes by a pumping station equipped with specially designed Worthington acid-resisting pumps.

These liquors percolate through the heaps to the base, where they are collected in drains delivering into earthenware pipes, and gravitate to a suitably situated system of precipitating tanks and canals. In these the liquors pass over scrap iron, which precipitates the copper. The overflow water from the canals, which contains some sulphate of iron as well as a little free sulphuric acid, is returned to the heaps by the distributing pumps. The amount of leaching liquors in circulation is approximately 600,000 gal. per day. A pumping station at Moonta Bay, about three miles distant, provides sea water for making up the leaching liquors and losses through evaporation and soakage.

So far, the present company has not undertaken the treatment of the slimes, of which about 380,000 tons are available. These are distributed in shallow heaps for oxidation, and the former practice was to accelerate this process by turning over the surface with horse-drawn plows. The loose portion was subsequently skimmed off by wheeled scoops and transferred by rail to a special treatment plant. At the latter, the material was passed through agitators with five tons of water, and from 14 to 18 lb. of sulphuric acid to each ton of slime. The resulting pulp was settled in dams, from which the copper-bearing liquors gravitated to the precipitating section.

The Thorium Industry

In commenting on the British tariff on gas mantles of 6s. a gross and one-third of the value of thorium nitrate, *Die Metallborse* gives some interesting information regarding the thorium industry, says *The Mining Journal*, of London. The German journal states that the English thorium industry is a comparatively new one, as it was a German monopoly until recent years. Since 1895 Brazilian monazite has been shipped to Hamburg as ballast and sold to the German Thorium Co. through J. Gordon, who exploited the Brazilian monazite deposits under an arrangement with Brazil.

These deposits were situated near the coast in Espirito Santo. In 1903 Gordon had difficulties with the government, which then gave the exploitation rights to a firm known as de Freitas, but Gordon entered into an arrangement with this firm and was able to continue supplies of monazite to the German Thorium Co. until 1909, when the agreement expired. In that year, however, the rich monazite deposit of Travancore, India, was discovered, the ore from which was about twice as rich as that from Brazil, so that the German supplies were continued and maintained up to the outbreak of war. As a result of the war, the German interests passed into British hands. The Travancore Minerals Co. was allowed to work the deposit only on the understanding that at all times the English thorium works were to be supplied with monazite sand at fair prices, and that no price concession should be made to other buyers. This ended the German monopoly, and the thorium industry was able to develop in England. Besides the above company, Messrs. Hopkins & Williams and Thorium, Ltd., supply monazite sand, and at present there are four concerns in Great Britain which work it, either for gas-mantle production or the preparation of thorium compounds. Under the new tariff arrangements both these branches are protected against foreign imports.

Helpful Hindrance

By D. E. A. Charlton

"To get tha bes' work h'out o' men," said Cap'n Dick, "h'ts better sometimes to let them do sumthin' h'on their h'awn, naow an' again, 'less h'it be that they be not fit for to do thinkin' for they selves. I mind one time h'up h'in Minnesota w'en Jimmy Treloar 'ad charge o' a crew a furriners 'oo were trimmin' a bank h'in one o' tha h'open pits. These ere chaps were fresh h'over, an, seemin' like, they weren't h'awful good workers. Tha super 'ad h'ordered a lot o' these 'ere safety belts, with ropes h'on they, an' 'ad given h'instrucshuns for tha men to wear they w'en they wuz workin'. But h'in makin 'is raoun's 'ee noticed that none o' they 'ad un on, an straight ee started to blaw h'up Jimmy for not carryin' h'out h'orders. 'Well,' sez Jimmy, 'tedn't that I wuz dis-h'obeyin h'orders, Mister Super, but with these 'ere bo'unks h'it be 'ard nuff for to get to work, h'any'ow, let alone tying' they.' "

Welfare Work at Anyox, B. C.

Contentment Among Workers Is One of Its Principal Objects—Schools and Hospitals Maintained—Entertainment Provided—Sports Encouraged

By F. M. Kelley
Welfare Agent,
Anyox, B. C.

ANYOX, B. C., is the operating headquarters of the Granby Consolidated Mining, Smelting & Power Co., and is situated on Granby Bay, Observatory Inlet, about six hundred miles north of Vancouver and over one hundred miles from Prince Rupert, its nearest neighbor city. Anyox is a company town, and with the exception of the gold commissioner, postmaster, custom's officer, and government telegrapher all the residents are workers in the employ of the Granby company. Production of ore from its Hidden Creek mine and the concentration and smelting of the ore are the principal operations, together with a byproduct coke plant, which supplies the necessary fuel for smelting purposes. Plant and town are well contained, with all the necessary works departments functioning so that operations may be continuous. The working force is represented by a thousand men, the women and children making up about an equal number.

Co-operation Between Employer and Employee

The Granby organization has been highly spoken of from its earliest mining days, and the fact that the plant continued to run when a great many of the large copper-producing concerns were forced to shut down, two years or so ago, speaks more eloquently than words of the value of the co-operation which exists between the management and the employees. This happy condition could only be the result of mutual respect; and this respect is more or less conditional on the extent of the interest taken in the welfare of the worker by managing officials.

A worker, to do his best, must be contented with his environment, even if it is not of the most desirable in grimy towns; he must have entertainment to suit his pocket and his fancy at the same time, and he should have every means to keep fit, mentally and physically. This has been the object desired, and largely attained, by the Granby organization in Anyox.

The company provides hospital facilities of the highest order, with a competent staff of doctors and nurses for the care of the sick and injured, the cost to employees being $1 a month for single men and $2 a month for the man with a family. Schools which are second to none in British Columbia are maintained for the education of its employees' children. Night classes, in charge of qualified instructors, are operated by the School Board for the benefit of those workers who desire to study and who cannot attend day school. This is a feature of the winter nights and embraces grammar- and high-school subjects, English for foreigners, electrical practice, mechanical drawing, metallurgy, mineralogy, boiler-shop practice, building construction, steam engineering, and steam fitting. In connection with these classes, the technical library of the company, which is a very complete one, covering every phase of Anyox operations, is available to the student.

The Anyox mine baseball team

To make conditions safe, consistent with reason, for the man on the job is also the aim of company officials, and a safety-first committee has this work in hand, doing a splendid service, despite the ridicule lately expressed in some quarters and aimed apparently at the safety movement. Taking the spice of danger out of the worker's life may appear foolish to some; but it is worth something to have whole-limbed workers and happy families through the practice of safe methods rather than armless men, with diminished earning power, and sad-eyed women and children in the community. The property value also must be considered. Careless workers have done a lot of damage in their time, and will continue to do so if allowed to run wild.

The Community League and Its Functions

Apart from the welfare work directly taken care of by the Granby company, Anyox possesses an organization which is unique in the industrial world. We do not know of another quite like it. What is known as

View of residential section of Anyox

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief. Letters will not be printed unless the author's name and address are known to the editor.

Americans vs. Mexicans in Arizona

THE EDITOR:

Sir—In reading over Robert B. Dickson's article on "Americans vs. Mexicans in Arizona" (*Mining Journal-Press*, Jan. 30, 1926), it seems that he has overlooked the question of the mobility of labor in the mining camps. The Mexican, when he comes to a mining town, intends to settle down and in time, if married, to bring his family to live with him. The average American, if a young mining engineer, comes to the camp to gain a little experience and then to travel on, or, if an old-timer, to make a stake and hit for the next camp. Managers of mines are thus confronted by the problem of a steady supply of fairly good labor or an erratic supply of good labor. Sound business sense necessitates the company taking, in several cases, the former supply.

As for the question of choosing between an American and a Mexican for a mucker, the mental make-up of the two different races will readily prove that the Mexican will prove more satisfactory for the muck stick. In regard to giving Mexicans preference for Leyner, timber-helping, chuck-tending jobs, and so forth, I cannot recall one case when the American was not given the job, at the United Verde Copper Co., when he was at all fitted to perform the task. It is also of note that some of the best miners and timbermen at this mine are Mexicans.

America for Americans, certainly, but let us give the other fellow a chance, and, if he makes good, not berate him simply because he is of a different nationality. I am also a young engineer trying to break into the mining game, but I have found that the companies in this state give the young man every possible chance to take up mining if he so desires. W. H. HOPKIN.

Inspiration, Ariz.

Caduca

THE EDITOR:

Sir—Knowing how careful you always have been in your statements and the wide circulation which the *Mining Journal-Press* has among people interested in Mexico, who accept it as an authority, without considering the author of an article, I beg to call your attention to several inaccuracies in the article entitled "Caduca" in your issue of Feb. 20, which inaccuracies, if allowed to go unchallenged, might cause innocent parties to forfeit their property.

In the third paragraph the writer states: "If the tax be not paid within a period of four months, a fine is imposed, which increases for each subsequent four-month period. . . ." This statement is manifestly incorrect: Article 20 of regulations governing the application of the mining tax law reads as follows: "The payment of the annual tax on claims shall be made within the first month of the corresponding 'tercio' (four-month period, that is, January, May, and September). . . . "Delinquency will cause a penalty of 10 per cent, if the payment is made during the course of the second month; of 25 per cent, if made during the third, and of 50 per cent, if payment is made during the last month of the period, as provided in Article 15 of the law of March 4, 1924. Said period having terminated without the tax and corresponding penalties having been paid, excepting in cases of major force, duly proven, in the judgment of the Treasury Department, said department shall cancel the fiscal registration of the title, ordaining publication of such cancelation in the 'Official Daily' and so advising the Department of Industry, in order that, following due legal procedure, said department may declare forfeiture of title."

In the same paragraph the writer states that the application for title is accompanied by a receipt for the payment of the first year's taxes. This also is incorrect: Article 5 of the regulations provides that the application for title shall be accompanied by the second of the receipt issued by the proper stamp office, covering a deposit for the amount of the stamps required (10 pesos per hectare) on the title, if issued. Article 6 provides that in case the application is not admitted, said deposit shall be refunded to the applicant. Article 21 provides that taxes on new claims shall be assessed from the date of the issuance of title.

El Paso, Tex. G. CLYDE HARDING.

Genesis of Sulphide Ores

THE EDITOR:

Sir—The article by Mr. Freeman in your Dec. 19 issue seems contrary to all field observations. The discovery of liquid inclusions of H_2O and CO_2 in even the deepest pegmatites and magmas and the formation of veins of native metals from types of basic magmas that are capable of forming differentiation deposits of sulphides seems a severe blow to any theory using dry Na_2S as the chief solvent.

In any mixed solution in which a strong acid is in great excess, all the acids that occur in minor amounts tend to be freed from their combinations. Silica is a very active acid, at high temperatures, and tends to crowd out all the easily soluble or volatile acids with a small part of the silica from magmas in which silica is in excess. These acids (the haloid acids, boric acid, hydrogen sulphide, and carbonic acid) carry with them the metals most soluble in them. These acids are much less completely expelled from basic magmas and likewise

the Community League sponsors all matters pertaining to the general welfare other than those departments already mentioned. It is an organization of voluntary membership, with an elective council at its head, and consisting of eight councilors, one of whom is elected

The Anyox basketball team, the "Bluebirds"

president. Another is elected vice-president and still another second vice-president. These three officers, with two appointed by the company, constitute the finance committee. The remainder of the councilors, as heads of departments, the principal of which are recreation, forum, entertainment, choral, and dramatic and home and school, are appointed by the chairman. The secretary-treasurer of the league is the welfare agent of the Granby company and also adviser to the council, and supervises all activities. The company pays 50 per cent of the secretary's salary, and the cost of publishing *Granby News*, a weekly camp medium which is written by the secretary in the interests of the league. All other expenses are met by the league.

Membership in the league is open to everybody in the camp, and is purely voluntary, the fee being 50c. a month. This covers library, reading room and gymnasium privileges. Though this revenue helps to meet the expense involved, it does not begin to cover the cost of the various activities sponsored by the league. The main source of revenue is in the operation of recreation halls at the beach and the mine. The hall at the beach contains two floors devoted to amusements. One floor is equipped with billiard and pool tables and a cigar, candy, and soft-drink stand and the other is used as a picture show and dance hall. The hall at the mine contains a pool room and a stand selling the same commodities as the beach hall. These premises are under rental from the company, and before the league acquired tenantship were rented to outside parties, and naturally whatever was made did not return in any way to the people, because they had already received value for their money.

Receipts from the activities mentioned as now being handled by the league support a library and reading room, two gymnasiums, ball grounds, tennis courts, and children's playgrounds. The income also fosters three basketball leagues including twelve teams, a three-team league, each, of baseball and football, besides providing dances and field days for kiddie and grown-up. The gymnasiums belong to the league, and were completed two years ago at a cost of $14,000, which amount was derived from its commercial activities. At present the library contains about three thousand volumes of fiction and general literature, and is constantly growing. The reading room has eighty magazines and periodicals regularly on file, and is a favorite resort for men "off shift."

Competitive Sports Encouraged

Not being able to engage, except on rare occasions, with outside teams in games of general interest, the fact that Anyox is divided into two communities (the mine and the beach areas being about a mile apart) presents the necessary opportunities for rivalry of the right sort, and many are the close contests witnessed by the fans when beach and mine teams are engaged. In 1923, in a post-season baseball series, five games were played to decide the championship. Each game was won by one run, and the difference in the total runs scored was only one tally, the score of the winners for the five games being eleven runs in all. Contests of this nature tend to make the players and the spectators forget the job for the time being, and they are surely the better for it. The mine teams are handled by the Mine Club, an organization that does everything possible to have its representatives out in front when the schedules are finished.

Though the Community League is now a smooth-running organization, with a healthy surplus in the bank, it had its early vicissitudes, and on several occasions there was not much between its success and failure. It won out, however, and is appreciated by the big majority of Anyox people, whether members of the league or not, and is supported by the company at all times. Its motto is "service," and to some extent this is rendered; otherwise it would have no excuse for existence. Taking care of the problems of a community which are generally the source of some worry to the busy executive, the work of the Anyox Community League might be copied with advantage in other branches of industry; for if operated under the same conditions as at Anyox there would be no doubt as to the final result.

Amorphous Carbon and Graphite

O. Ruff, G. Schmidt, and W. Olbrich, in an article in the *Zeitschrift für Anorganische Chemie* (1925, 148, 313-331), abstracted in *Chemistry and Industry*, state that the conclusion of Debye and Scherrer and of Kohlschütter that amorphous carbon is merely a finely divided form of graphite is probably incorrect. Amorphous carbon is a true modification which at 1,100 deg. begins to pass into a "paracrystalline" form, the properties of which approach those of graphite. The numerous forms of amorphous carbon are to be attributed to the presence of varying proportions of graphite, amorphous carbon, and the "paracrystalline" form. Only true amorphous carbon can be activated, activation being associated with the property of adsorption from solution.

per cent of the known iron meteorites of the world) and the aerolite which burst over Holbrook some years ago were the only true visitors from the sky in this region. It is obvious that we mining geologists have a great deal to learn from some of our petroleosophical colleagues.

In conclusion, let me ask Mr. Hager, if he has any further information about the crater, not to withhold it any longer, for it is against the highest duty of the scientist to retard, in any way, the spread of scientific knowledge. DANIEL MOREAU BARRINGER.

Philadelphia, Pa.

Mining Makes Strange Bedfellows

THE EDITOR:

Sir—I notice in your paper an editorial with reference to the promoting of the Western Lead Mines Co. by Mr. Julian. Let me say I heartily agree with everything you state in that editorial, even though I am one of the victims of your criticism. I am inclosing a copy of a letter which I gave to the California Corporation Commissioner stating the circumstances under which my report was rendered to the Western Lead Mines Co. The truth of this letter has been certified by Mr. Coe personally before the State Corporation Commission, to which I refer you for verification of my statements.

I feel very much like having been used to "pull the coals out of the fire," and if I had entered into this knowing what was going to develop I surely would be open to the criticism which you have made.

Let me state, as mentioned in the inclosed letter, that I went over the properties of the Western Lead Mines Co. with the understanding that I was to report on the structure only. I repeated over and over again to Mr. Coe and to Mr. Salisbury, who was president of the company at that time, that I was not a mining engineer and that I knew very little about ore deposits. I have had considerable experience in working in the Coast Ranges of California, and feel that I am thoroughly competent to work on structural problems, and it was solely for that purpose that I was employed—at least that was my understanding.

I would appreciate very much if you would publish this letter, together with the inclosed letter which I gave to the California Corporation Commission.

Berkeley, Calif. BRUCE L. CLARK.

The letter that Professor Clark refers to is as follows:

Berkeley, Calif.,
Feb. 5, 1926.

To whom it may concern:

This is to certify that my name is Prof. Bruce L. Clark and that I am employed at the University of California as Associate Professor of Paleontology and that I am not a mining engineer.

That my name which is being used by C. C. Julian in his advertisements of the properties of the Western Lead Mines Co. was not used with my knowledge and consent and that my original report on the properties of the above company was not made to Mr. Julian.

That that portion of the report published in the daily press at Los Angeles quoting me is not that part of the report which I wrote but was written entirely by Mr. Coe and is not an accurate translation of that part of the report written by Mr. Coe himself from which we rendered a joint report.

That I was hired to examine the properties of the Western Lead Mines Co. by Mr. Ira Coe, an engineer, for whom I had previously done some work. As I understood it, the object was to examine the geological structure and I stated very positively to Mr. Coe that I was not a metalliferous man and that my judgment as to the value of ore deposits ought not to be taken into consideration, that what I was making an investigation for was to determine the structural relationships at the mine and the occurrence of the orebodies. My report was confined to that only.

That I did not know that Mr. Julian controlled the mine or had any interest other than being an ordinary stockholder. I was told that Mr. John Salisberry was president and I believed that the undertaking was legitimate prospecting. That I had no dealing whatever in a business way with Mr. Julian and did not at any time know that I was employed for him.

My report was addressed to the Western Lead Mines Co.

(Signed) BRUCE L. CLARK.

Sand Filter Bed Has Longer Life

THE EDITOR:

Sir—Based on the article in *Mining Journal-Press* of May 30, 1925, the statement was made by me in the Annual Review Number of Jan. 16, page 110, that the sand filter bed of the Golden Cycle or Hardinge Superthickener requires renewal at intervals varying from a week to several months. The manufacturers of this apparatus now inform me that this wide range has been much reduced and the general practice is to recommend cuts of from one-eighth to one-quarter inch per day, thus making the life of the sand filter bed from 240 to 480 days. This new information is of sufficient importance to warrant its publication by you, and I therefore hope that this letter may appear in the *Journal-Press* in the near future. CHARLES E. LOCKE.

Cambridge, Mass.

A Correction

THE EDITOR:

Sir—The issue of *Engineering and Mining Journal-Press* for Nov. 28, 1925, has just come to hand, and in going through the article on South Africa, I find a slight error. On page 853, in the second column, you state that I worked at the Kennecott mine. You have evidently confused the name of the company, as the place I met Mr. Rickard years ago was at Hurley, N. M., the Chino plant. I have never been to Kennecott, although I have used the very valuable data that has been published by Messrs. Eddy and Lawrence in my work.

My work on this process consisted mainly in the construction and operation of the pilot plant (under the direction of Minerals Separation engineers), from which data the 1,000-ton plant has been built. I have freely used the data of both the Calumet & Hecla and Kennecott plants that have been published, and during my short stay at Calumet Mr. Benedict gave me very valuable assistance that has been of great help in working out this problem. Will you be so good as to make this correction in fairness to the Kennecott company and their staff.

The plant here should be in operation about June next, and I am sure it will be a success.

WILLIAM J. CAYZER.

Bwana M'Kubwa, Northern Rhodesia.

the valuable metals soluble in them. The large part played by water in these solutions is proved by the fact that the primary vein minerals are all insoluble in water. Otherwise some of them would surely be soluble.

I hold the idea of an acid complex vein-forming solution in which the different acids have their principal zone of activity at a fairly constant temperature in the order of silicates, haloids, sulphides, and carbonates. The metals are not precipitated as sulphides until the solutions become neutral or basic by dissipation in the wall rocks of the more active acids or absorption of bases from them. The metals precipitated prior to this stage are mostly oxides, and the depositing solutions rob the walls of basic elements. We find this order in volcanic emanations and by taking analyses at different distances from veins in the wall rocks as well as in the veins themselves.

The metals are precipitated in simple cases in the order: gold, silver, copper, zinc, and lead, and I think any deviation from this order can be amply explained by the solvent action of excesses of hydrogen sulphide and the soluble sulphides. We find the veins to vary most from this order in the districts where the wall rocks and veins show large excesses of hydrogen sulphide.

In many cases the metals have been reduced to native metals when the H_2S was insufficient or carried on until the wall rocks could furnish the needed H_2S for the precipitation. This surely indicates the mineralizers (principally chlorides) as the chief solvents in the rock magmas. A vein solution need never have an excess of bases to show a basic reaction, as the H_2S and the H_2CO_3 are weak acids and could exist in considerable excesses and the solutions still show basic reaction.

Follett, Tex. L. L. DRAPER.

Sex in Minerals?—Sure!

THE EDITOR:

Sir—In *Mining Journal-Press* of Feb. 13, 1926, page 291, I note that a Soviet scientist "has disclosed important evidence of sex in minerals." Of course we know that the Soviets, steeped in their own cussedness, have not had much to do with foreign civilization for some time, but it is surprising that their scientists have not known of the recognition of sex in minerals that has been patent in mineralogical science for a long time. The names of minerals show this recognition. For instance, we have he-matite, and he-matolite; and on the other side we have schee-lite and she-pardite. Some have even been named with the possessive, so that we have his-ingerite and his-lopite, and correspondingly her-cynite and her-derite.

Without such direct reference, and possibly greater personalization of minerals, we have Olive, Carmen, and Lillian -ites, and correspondingly David, Henry and Herman -ites. And who does not know Mag-nesia? The uncertainty of the mineralogist in naming some brand-new minerals, or possibly the recognition that some minerals are neuters, is denoted by it-abyrite and itt-nerite.

Not only is the sex of minerals recognized in the nomenclature, but family relationships are noted also. Pa-godite and mama-nite are evidently parents, and pett-erdite is undoubtedly a favorite child of the family.

Washington, D. C. MARC PAWL.

Craters and Sink-holes

THE EDITOR:

Sir—Mr. Dorsey Hager's letter about Meteor crater, published in your issue of Feb. 27, has just been called to my attention. It is indeed a profound revelation to me. We all owe Mr. Hager a debt of gratitude; I, because he has shown me that all my twenty-three years' work, which I had thought proved the origin of the crater to be meteoric, has been wasted; and all other geologists as well, for he has proved that sink-holes can occur in sandstone, and can cause rocks to fall upward out of a hole as well as downward into it.

It will be something of a blow, I am afraid, to many of the men who have thought, as I have, that the hole was made by a meteorite. Drs. Elihu Thomson, W. W. Campbell, H. L. Fairchild; Professors Henry Norris Russell, W. F. Magie, William B. Scott; Dr. George P. Merrill, of the Smithsonian, the foremost authority on meteorites in the country, and the many others who have foolishly believed that I was right, will have some difficulty in changing, as now they must, their long-formed opinions about it. But we must live and learn. What a pity it was that Mr. Hager's paper, which he says he prepared for the Chamber of Mines and Oil *Bulletin* of Los Angeles, was not published, for it would have saved some of the most distinguished men in the country from the ignominy of forming opinions which were in direct conflict with the results Mr. Hager obtained from his investigation. And what would not the Crater Mining Co. have given for the knowledge which Mr. Hager so unkindly withheld from them, allowing them to go to the expense of drilling for the meteorite when a word from him would have shown them that no meteorite could be there. It hardly seems right that he should have left so many of us in ignorance of the true explanation for so many years.

I have heard various other theories of the origin of the crater during the time that my friends and I have owned it—theories of volcanoes, of steam explosions, and even one gem that explained the meteorites as being the result of reduction of the iron in pyritic concretions in the sandstone. But at last I have seen the light, and the real origin of the crater is now clear. It is a sink-hole! But not an ordinary sink-hole, such as is often found in limestones. Far from it. This sink-hole was formed in sandstone (97.5 per cent silica). And, what is more, instead of sinking, the rocks in this remarkable hole rose up, and fell around the outside of the hole, some of them even flying more than a mile away from it. And at the same time some of the rocks in the hole were highly heated, some of the sandstone fragments so highly that they melted—a thing no other sink-hole has so far been able to cause. And millions of tons of the sandstone, before coming out, were shattered into the finest rock-flour—also, no doubt, by sinking. It gives one pause to think how easy it was for Mr. Hager to figure all this out on one visit, and to put it all clearly and convincingly in a half-column letter. Oil geology is manifestly too small a field for him.

Another thing he brings for the first time to my attention, and to the attention of all who know Arizona, is that meteoric fragments are quite common in that part of the state, and are not confined to Meteor crater. To think that I have continually been encountering meteorites in Arizona without recognizing them, thinking in my ignorance that the meteorites around Meteor crater within five miles of which have been found 90

Consultation

Filtering Thick Pulps

"Why is a thick pulp desirable to obtain efficient results in filtering or dewatering on machines of the revolving-drum or revolving disk type?"

This question is discussed in a paper entitled "Mechanism of Filtration," written for the A.I.M.E. by Arthur W. Hixson, Lincoln T. Work, and Isaac H. Odell, Jr. The paper points out that in recent years, authorities have become practically unanimous in saying that the actual filtering should be done not by the cloth itself but by a layer of solid particles deposited upon it. Thus, a cloth may be used in which the openings are considerably larger than the particles to be filtered, provided groups of particles form an arch or bridge over each opening. This can be accomplished if the initial pressure is so low that the arch will not be broken while it is still thin. According to Wright, the chief advantage of this method of filtration is that the open-weave cloth does not become clogged as easily as does one of closer weave, where the fine particles often work their way into the interior of the cloth and become caught there. If the character of the material to be filtered is such that it will not form a good film, then it becomes advantageous to use "filter aids" for pre-coating the cloth with a desirable layer of solids, and the coating need be only of a very slight thickness for good results. Until the film is formed, the first runnings of the filtrate may be cloudy, often necessitating refiltering this portion.

A factor which has considerable effect on the performance of filters is the concentration of solids in the pulp. According to Wright, a high concentration of solids gives a porous cake, since the flow is then slower than with a thin pulp. The porosity of the cake is also affected by the pressure. A high initial pressure tends to compact the cake, and the same effect results from fluctuations of pressure. In his studies of the relation between pore size and particle size, Hatschek observed that the particles in a pulp tend to arrange themselves with maximum cross-section parallel to the direction of flow and that this is more marked at the higher velocities. Thus, at high pressure and high velocity, a certain pulp will pass through a given filter cloth, whereas, at a lower pressure and a correspondingly lower velocity, a cake will be built on the cloth.

It is also probable that, at high pulp densities, there is a condition which renders cake formation easier than in more dilute pulps. High concentration of solids may affect the particle arrangement, in that there will be less tendency in the thicker slurries for particles to arrange themselves with their greatest cross-section parallel to the direction of flow. Moreover, the finer particles when close together may have more tendency to take part between the larger ones in the filter bridge formation, thus increasing the diameter of the bridge. In other words, with thick pulps the combined action of the various sizes may be greater than the sum of their separate actions.

Market for Rock Crystal

"I should be greatly obliged if you would inform me as to whether there is a market for pure quartz (rock crystal), and if so if you could put me in communication with possible buyers, or mention through your columns whom these buyers may be. Furthermore, can you give me some indication of the price paid for such material, also as to whether any premium is paid for large-size pieces and exceptional clearness?"

Practically all of the optical rock crystal used in this country comes from South America and Madagascar. There are probably other deposits of optical-grade rock crystals in the United States, but so far as is known only one of these has ever produced on a commercial scale. The mine which was producing is located in California and is now flooded.

The crystals come on the market in several grades, which have been carefully sorted according to size and weight. The pieces range from 100 to 200 gm. up to 1 to 5 kg. Crystals weighing more than 1 or 2 kg. are exceptional and sell at fancy prices. The price range for the smallest-weight crystals is around 20c. to 30c. per lb. delivered, American seaport. This is subject to a duty of 10 per cent. Larger crystals sell for several dollars a pound and upward, depending on shape and freedom from flaws.

All of the optical grade must be water-clear and must be quite free from any suggestions of internal phantoms or clouding, feathers, flaws, or fractures. The external condition of the crystal in no way affects its value. By this is meant whether it is coated with a film of iron oxide or has been etched. The crystals are generally packed in boxes with sawdust to prevent rubbing during transit.

This information is from the Foote Mineral Co., of Philadelphia, importers and buyers of many mineral products.

Foreign Mine Ownership in Australia

"Can you tell me whether there are any restrictions in Australia preventing the holding of mining property and the exploitation of mineral deposits by aliens?"

According to the Commissioner in the United States for the Commonwealth of Australia in the State of New South Wales, the Crown Lands and Closer Settlement acts place restrictions on the acquisition of Crown lands by aliens, but in the Mining Act there is no mention of any such restriction. In the State of Victoria every alien friend resident in the state may acquire and hold real and personal property in the same manner as if he were a natural-born British subject.

In the State of Queensland no Asiatic, African, or Polynesian alien may exercise any privilege, under a miner's right, except that of alluvial mining, nor may he hold any lease or business license. In the State of South Australia the only reference to the tenure of lands by aliens is in the Irrigation Act. In the State of Western Australia there is no restriction forbidding the holding of land by aliens.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

SENECA ships 1,000 tons of ore daily; Ahmeek 3,500 tons; Quincy encounters Pewabic lode; Bohemia Mining Co. to be sold at auction April 8.

Consolidated Lead & Zinc acquires Wade lease, and with Eagle-Picher produces 20 per cent of ore in Joplin-Miami district.

Extension of Pittman silver purchase act meets opposition of Treasury Department.

Proposal to recover lead slime from Coeur d'Alene River, Idaho, by dredging.

First unit of Noranda smelter to be 1,000 tons' capacity; subsidiary operating company organized.

Placers active at Superior, Mont.—Elm Orlu increases lead-zinc ore production to 50 tons per week—Plans to rework tailings of Granite-Bimetallic mine.

International Nickel enlarging Port Colborne refinery—Tonopah Canadian to begin 150 ton mill in May.

First airplane trip to Red Lake district. Passenger and express rate $1 per pound.

Silver King Coalition Mines, Utah, has prosperous year, with gross production in excess of $4,000,000.

Quartz Mountain mine, Luning, Nev., to be reopened.

Canterbury tunnel opens new ore in Leadville district.

Attempt to Recover Lead Slimes in Idaho by Dredging River Bed

C. L. Hewett, mining engineer and metallurgist, of Kellogg, Idaho, has secured a lease from the State of Idaho on the Coeur d'Alene River for several miles in Shoshone and Kootenai counties, his purpose being to recover the lead slime in the bottom of the river by dredging. This is an interesting enterprise, one that has been considered by various parties for many years.

The Coeur d'Alene River is formed by the confluence of the North and South forks which drain the entire Coeur d'Alene mining district. It is along the South Fork that the mills of the district are situated, and for forty years their murky water has befouled the stream. In the early days, and in fact up to the adoption of the flotation process, a comparatively few years ago, the mineral loss in milling operations was heavy, and the waters of the South Fork were literally impregnated with fine particles of lead-silver ore. Being a torrential stream, these particles had no chance to settle until they had been carried down the river for twenty miles and entered the Coeur d'Alene River, which is a sluggish stream flowing for thirty miles through the Coeur d'Alene valley into Lake Coeur d'Alene. Thus, when the turbulent lead-ladened waters of the South Fork entered the main stream, the fine mineral particles held in suspension found their way to the bottom, and there they have been accumulating for many years.

Mr. Hewett is no novice at recovering profit from the loss of others. He has been successful in working old mine and tailings dumps, and he now plans to place a dredge or some other device on the Coeur d'Alene River to recover this accumulation of lead slime, which, based upon tests, is expected to yield a substantial profit.

Park-Utah Largest Silver Producer in Utah

COMPILATION of the production of Utah mines for the year 1925 shows that the Park-Utah Consolidated Mines Co., with a production of 4,815,002 oz. of silver, was the largest silver-producing company in the state. The Tintic Standard mine, with a total of approximately 3,800,000 oz., produced from ore taken from one shaft, the No. 2, still retains the honor of being the largest silver-producing mine in Utah. Third in rank in the production of silver in Utah belongs to the Chief Consolidated.

Paradise Mine, Invermere, B. C., Under Option to London Firm

R. Randolph Bruce, who has returned to British Columbia from Great Britain, to assume his new duties as Lieutenant-Governor of the province, has announced that while in London he gave an option on the Paradise mine, near Invermere, to a London syndicate. The consideration is about $300,000. "I have stipulated," the Governor added, "that until the sale is concluded and I am entirely out of it there shall be no public flotation of stock of the syndicate to which I have given the option."

Quincy Encounters Pewabic Lode —Seneca Ore Yields 23 Pounds per Ton

The rich vein of copper opened in Quincy Mine, in the Michigan copper district, has been cut in five different places in Nos. 2 and 6 shafts. Four of these are around the 86th level in No. 2 and the other is at the 83d level of No. 6 shaft, 1,500 ft. away, which is the longest distance between openings. In No. 2, the vein has been opened for 125 ft. in one place and at another, on the opposite or south side of the shaft, 500 ft. away, for 20 ft. It also has been cut 80 ft. above and 80 ft. below the original point of contact. The average width appears to be 10 ft. Though it is called a "new" vein, it is in reality the old Pewabic lode of the Pewabic bed series, which has carried no values heretofore. It is expected that opening work will be vigorously followed in the "new" vein to determine, as soon as possible, its permanency.

Seneca, the newest producer in the Michigan copper district, is producing rock which yields about 23 lb. of refined copper per ton. Average daily rock output is at the rate of 1,000 tons. Nos. 1 and 2 shafts are producing at about the same rate.

Two stamp heads are being used. Seneca mineral is smelted at the Michigan smelter, which also treats Copper Range and Mohawk mineral. No. 1 shaft is being sunk to the eighth level.

Ahmeek, a unit of Calumet & Hecla Consolidated, is shipping 3,500 tons of rock per day, including considerable mass copper from Nos. 3 and 4 shafts. Heretofore, mass has come largely from No. 2 shaft, in which an extensive fissure vein of mass copper was cut.

Hassayampa Gold Orders Large Dredge

The Hassayampa Gold Placer Co. has placed a contract for the building of a large gold dredge by the New York Engineering Co. The company plans to install the dredge at its placer workings on the Hassayampa River, north of Phoenix, Ariz. These workings have been extensively drilled and tested during the last year under the direction of Charles M. Donohue, with Kirby Thomas, of New York, as consulting engineer. The company has also acquired and is developing two mining properties in the Wickenburg district. Plans are being made for the construction of a power plant at Hot Springs Junction.

Consolidated Lead & Zinc Purchases Wade Lease

The Consolidated Lead & Zinc Co. has purchased the Wade lease of the Childress Lead & Zinc Co. in the Joplin-Miami field. The consideration was not made public. The Childress company retains the mill, which will be moved to one of the leases that it is now drilling. Acquisition of the Wade lease will make it possible for the Consolidated company to operate the Tulsa-Quapaw mill at full capacity. It is one of the largest mills of the district, capable of handling sixty tons of crude ore per hour. A tram running to the south shaft of the Tulsa-Quapaw property will be extended to the mill shaft on the Wade lease.

Negotiations are under way for the acquisition of another important property that produces approximately 10,000 tons annually

Sales of lead and zinc concentrate by the Consolidated companies for the week ended Feb. 27 totaled 1,441 tons, for approximately $72,000. Eagle Picher tonnage was valued at $200,000. Combined these companies produced 20 per cent of the output of the district. The Eagle-Picher company controls the Consolidated through ownership of 62 per cent of its B, or voting, stock.

Hollinger Mills 1,929,988 Tons in 1925; Value $8.18 per Ton

The annual report of the Hollinger mine, of Porcupine, Ontario, for 1925, shows new records of production, profits, dividends and operating costs. During the year 1,929,988 tons was treated, the recovery being $15,786,405, an average of $8.18 a ton. Operating costs were $7,829,000, an average of $4.06 a ton, which is a reduction of 40c. from the previous year. Operating profit was $8,300,000, an increase of $1,800,000. Dividends were $4,378,800, an increase of $1,180,000.

The ore reserves are estimated to have increased in value $5,300,000 from those of the preceding year. Power development is still carried as a capital asset at $5,907,000. This was sold to the Abitibi Power & Paper Co., but the details of the transfer have not yet been completed. Net cash assets, consisting of bullion, cash, bonds, and inventories as of Dec. 31, are $5,245,000, against $3,450,000 for the preceding year.

Sapphire Company Acquires Additional Property at Philipsburg

The American Gem Co., which for a number of years has successfully mined placer sapphire deposits in the Gem district, 25 miles southwest of Philipsburg, Mont., has acquired additional property in that district. Concentrates from the sluices are sent to Philipsburg, where the gems are sorted out by girls, who have become quite adept in the work. Sapphires are shipped to Europe.

Clark Estate Pays $6,500,000 Inheritance Tax

AS A PRELIMINARY inheritance tax, the Clark executors have paid the collector of U. S. Internal Revenue at Helena, Mont., $6,500,000 from the estate of the late Senator William A. Clark. Final adjustment will be made later, as the new income tax law, reduces taxes on estates of more than $10,000,000 by about one-half. Under the new law the proportion that Montana will receive from the United States will be increased.

The Clark estate was inventoried at approximately $49,000,000, and there has been paid to the Montana state authorities $900,000. Final adjustment will probably call for an additional $500,000 as state inheritance tax, according to estimates of J. W. Walker, chairman of the state tax commission.

Quartz Mountain Mine Reopened

The Quartz Mountain property of the San Rafael Development Corporation, which is situated near Luning, Nev., has been put in condition for the development of the 12-ft. face of high-grade ore left on the 190 level by leasers, according to L. D. Gordon, manager.

The company has put up a new headframe, built ore bins having capacity of 200 tons, and installed a new gasoline hoist, compressor, and engine, in addition to straightening and retimbering the incline shaft and erecting a hoist house, storeroom, and blacksmith shop. Accommodations for a crew of forty men are also being provided at the mine.

Plans have been made to start shipments from the 190 level, sink the shaft another hundred feet to develop the oreshoot on the 290, and also crosscut into the hanging wall on the 190 level to prospect for a vein parallel to that from which production up to date has come.

Elm Orlu to Increase Ore Shipments

Elm Orlu Mining Co. (W. A. Clark estate) is shipping about two cars of lead-zinc ore per week to its Timber Butte mill, from the Mount Washington mine, near Corbin, Mont. Steps are being taken to increase production to 50 tons per day. George W. Roddewig, general mine superintendent of the Elm Orlu Co., is in charge of operations.

Kirkland Lake Properties in Process of Merging

Negotiations are under way for a merger of the Elliott-Kirkland, Macassa, and United Kirkland properties, lying to the west of the Kirkland Lake Gold Mines. If the merger is completed sufficient capital will be arranged for to permit of extensive development, which can be carried out through the Elliott-Kirkland 525-ft. shaft.

During January, the gold mines of the Kirkland Lake camp produced $570,891 from 34,167 tons, an average recovery of $16.30 a ton. There was a slight increase over the record of the previous month in tonnage and value.

Kel-Mar-Pet Mining Co. Increases Capital

The Kel-Mar-Pet Mining Co., of Gold Hill, Oregon, has increased its capitalization from $25,000 to $150,000 and will begin the immediate construction of a reduction plant of 100-ton capacity at an expense of $50,000. Reduction equipment will consist of grinding mill, roasting furnace, re-grinding mill, and flotation separation machines. This company started last summer to drive an 800-ft. tunnel into the mountain back of Gold Hill to crosscut the big iron dike and Sylvanite vein running north-south through the Gold Hill district. The tunnel has been driven 600 ft. and it is yet several hundred feet from the known veins on the property. In the meantime eight blind veins of an aggregate width of seventy-eight feet have been crosscut in driving the tunnel at a depth of more than 300 ft. These orebodies contain gold, silver, nickel, and copper. The tunnel is being driven on a parallel east-west vein assaying $12 per ton in gold.

The Happy Thought Mining Co. was recently incorporated to drive a tunnel into the mountain on a tract belonging to the City of Gold Hill adjoining the Kel-Mar-Pet property on the south, and Salem (Ore.) people are organizing another company to drive a tunnel into the mountain north of the Kel-Mar-Pet property. The Gold Cross Mining Co., composed of Bend (Ore.) people, has mining equipment on the ground to drive a tunnel beyond the Sylvanite mine, cutting the same vein system that extends through the Sylvanite properties.

Placers Active at Superior, Mont.

Owing to the early thaw, there seems to be much activity in the placer fields near Superior, Mont. Graham & Brannon, of Tacoma, have been investigating the properties of the Cedar Creek Gold Mining Co., which controls the La Crosse property on Cedar Creek. Lee Hilliard and associates are planning the installation of a giant near Rivulet, and Dr. C. E. James, of Seattle, is planning to churn drill and sample the Oregon Gulch placer deposits.

Engineers representing Guggenheim interests have been making an examination of the Higley placers on Deep Creek. The Sheldon placer, on Two Mile Creek, is now operating, and others on Eddy and Trout Creek expect to resume work with increased crews.

Silver King Coalition Has Prosperous Year

The Silver King Coalition Mines company, operating at Park City, Utah, surpassed all past records during 1925 in regard to tonnage of ore mined, gross earnings, and net operating profits. Net smelter returns from the sale of 57,913 tons of first-class ore and 18,953 tons of concentrate recovered from 85,388 tons of milling ore aggregated $4,076,850.

In 1925, a new selective flotation unit, consisting of twelve Minerals Separation cells of 250 tons' capacity for the extraction of the lead contents and twelve similar cells for extraction of zinc contents, together with necessary grinding and other equipment, was added to the company's mill. Living quarters for men were augmented, 20,000 ft. of new and heavier rails laid, and new power lines were installed. Metal output of the company totaled 41,895,399 lb. of lead, 2,581,318 oz. of silver, 3,419 oz. of gold, 1,342,295 lb. of copper, and 742,362 lb. of zinc. Surplus for the year amounted to $2,484,032, compared with an adjusted surplus of $1,645,131 on Jan. 1, 1925.

Quicksilver in California

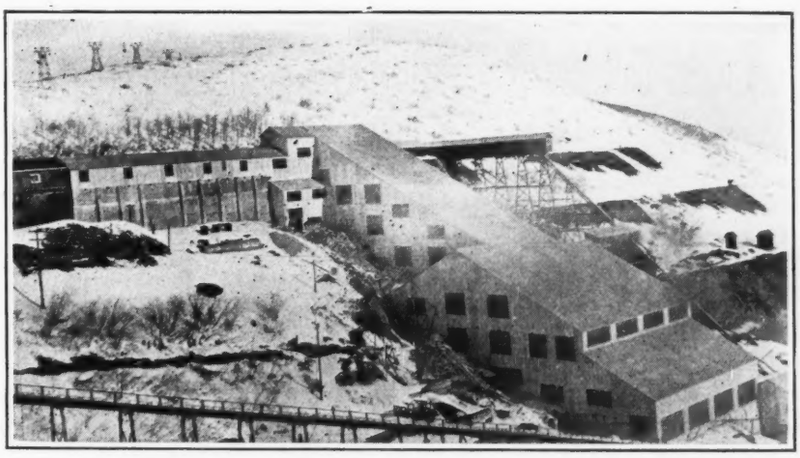
Quicksilver production in the United States slightly receded or about held its own during 1925, although the price is good and domestic demand is steadily increasing, and one producer who keeps in touch with conditions estimates that domestic demand will go to 50,000 flasks a year. The electrical industry appears to be absorbing greater and greater quantities; storage batteries, meters, and radios in the aggregate require much quicksilver. The amount absorbed by the chemical industry is an unknown quantity, but apparently it is increasing. Price stability on a world basis has been brought about by a loose selling arrangement between Spain and Italy. If quicksilver prices continue at their high level, greatly increased production is predicted within two years' time.

In California, the Helen quicksilver mine has been sold and the Sulphur Banks deposit taken over by Minerals Separation. New Idria continues production at its usual rate.

"Butte, the Unique"

The current numbers of the employees' magazines of the Union Pacific Railroad and the Postal Telegraph & Cable Co. contain illustrated articles on "Butte, the Unique," both of these being from the pen of Charles W. Towne, publicity director of the Anaconda Copper Mining Co. The article in the "Postal" especially is interesting to the layman, in that deep mining methods in the great copper camp are described in non-technical terms.

Shaft house, boarding house, and residences, Silver King Coalition Co.



Mill of Silver King Coalition Mining Co., Park City, Utah

Accounting Asked on Siskiyou Claims

A suit was recently filed in the Federal court in San Francisco by Mahlon R. Bryan, who asks for an accounting and the appointment of a receiver in the affairs of the Buzzard Hill Mines, a Delaware corporation sponsored by Henry C. Cutting. Newspaper accounts credit Bryan with the statement that he made an investment of $61,000 in the Cutting mining properties. Bryan alleges that development of the Buzzard Hill claims was not continued and that options on the Independence and other claims were obtained by Cutting in his own name and the machinery equipment of the Buzzard Hill group was used for working the latter claims. Bryan asks for an accounting and an explanation of Cutting's operations.

Increased Mining Activity in Northern California

Recent storms have increased available water in Trinity and Siskiyou counties, in northern California, and placer operations have been resumed. Hydraulic mining is under way on the South Fork of the Salmon River near Orton's Gulch; below Black Gulch and at Summerville. The Jefferson and Banner hydraulic mines on the East Fork of the Salmon River are being operated and other minor operations are under way. The Gallia mine, on the North Fork of the Salmon River below Sawyer's Bar, is being worked, as well as smaller properties in the vicinity. At Big Bar, the Blue Jay gravel mine is operating two giants. La Grange mine, near Weaverville, is being examined by Pierre Bouery with a view to determining the feasibility of resuming operations. Bouery was manager of the La Grange for a number of years when it was a large producer. The property has changed ownership a number of times, and has not been operated for almost ten years. The Trinity Dredging Co., operating above Lewiston on the Trinity River, has dismantled its old dredge and is installing the machinery on the new hull which was recently completed.

Does Prospecting Pay?

The conclusion of the sale of the Horne property by the Tremoy Lake Syndicate to the Noranda Mines indicates that the mining industry still offers opportunities for a fortune to those who are willing to take a risk. The Tremoy Lake Syndicate was formed a few years ago by Haileybury and New Liskeard people, who sent out Ed Horne to prospect in northwestern Quebec. The Horne property was located and sold to the Noranda. Under the terms of sale as completed, the syndicate received approximately $280,000 in cash and 125,000 shares of Noranda stock, which has a market value of about $2,000,000. The total expenses of the syndicate were approximately $5,000, or $50 a syndicate share, and return for each syndicate share is $2,800 in cash and stock having a market value of $20,000.

Airplane Service to Red Lake District, Ontario

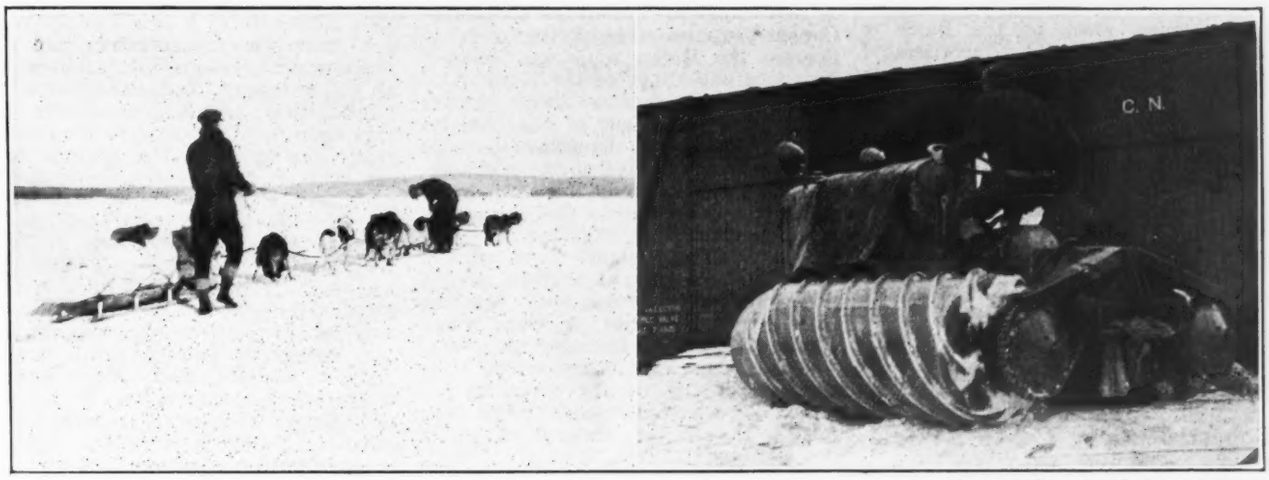
The first airplane to reach the Red Lake district, in Ontario, was the JN4, a Curtis plane belonging to the newly established Jack V. Elliott Aërial Mail Freight and Passenger Service, piloted by Harold Farrington. The round trip was made in 3½ hours on March 4, with the thermometer 30 deg. below zero. It would have taken the best of dog teams at least twelve days to make the 260-mile round trip. The charge for passenger and express service is $1 per pound.

In a recent paper by E. L. Bruce it is pointed out that prospecting in the Red Lake district dates back to 1893, when Doctor Dowling visited the area and gave the first good description of the sedimentary and basic volcanic rock. He made no mention of economic minerals. Soon after his visit, a quarter of a mile in and from the north shore of Slate Bay, a small shaft was sunk in the greenstone. Judging from the condition of the old shaft and buildings as they appear today but little ever came of this prospect, and no records have been found. Nothing more was done until 1922, when a little prospecting was carried on and many claims were staked. Assessment work on these claims in 1923 exposed a number of small veins containing visible gold. During the summer of 1925 continued prospecting resulted in opening larger veins, and news of the discoveries has caused a rush of prospectors and speculators into the district.

Reports coming from the Red Lake district continue to be satisfactory, and it is stated that a new vein has been found on the McIntyre ground south of the main break and that it has been traced into the Howey Red Lake ground, which is under option to the Dome. John Hammell, of the Howey Red Lake Syndicate, and Douglas Wright, geologist of the Dome, are now on their way out from the property, and complete assays will soon be available.

Photos by Canadian National Railways

Left: Two prospectors, who could not buy dogs, starting off on foot to the Red Lake gold field, pulling their supply-laden toboggan. Right: Unloading airplanes at Hudson, Ontario, on the Canadian National Railways



Photos by Canadian National Railways.

A halt for repairs on the trail across Lac Seul into the Red Lake gold field in northern Ontario
Unloading snow tractor at Hudson, the starting point for the Red Lake gold field

Drifting Eight Feet Per Eight-hour Shift

ANOTHER drifting record has been established in northern Ontario mines, at the Morrison property in Gowganda, owned by the Canadian Tonopah Mines, a subsidiary of the Tonopah. During a month of sixty-one eight-hour shifts a total of 494 ft. of drifting and crosscutting was accomplished, using one machine two shifts and working at two faces.

Isle Royale Ore Deposits Improving

Isle Royale, which is obtaining a yield of between 25 and 26 lb. of refined copper per ton of rock treated, is operating shafts Nos. 4 and 5. All new openings are in well-mineralized vein rock. Both shafts now are approximately 3,500 ft. deep. There has been a marked improvement in the copper content of the Isle Royale lode in recent years, notably in No. 4 shaft. In 1921, only 38 per cent of the ground opened in No. 4 showed good stoping values, whereas 75 per cent today is commercial. Isle Royale has three shafts in reserve and these can be worked to advantage when there is a better demand for the metal.

International Nickel to Enlarge Port Colborne Plant

The International Nickel Co. has decided to enlarge the Port Colborne refinery to permit of an increased output of electrolytic nickel. At present the capacity of electrolytic nickel at this plant is 350,000 lb. a month, and the proposed addition will bring the capacity up to 1,000,000 lb. a month.

It is understood that the estimated cost of the proposed additions will be about $750,000.

News From Washington

By PAUL WOOTON
Special Correspondent

Treasury Department Opposes Further Silver Purchases

Proposed Act, S. 756, to Provide $5,000,000 to Complete Terms of Pittman Law, Condemned in Minority Report

LED BY Senator Carter Glass, of Virginia, a former Secretary of the Treasury, the Democrats on the Banking and Currency Committee, with the exception of Senator Fletcher, of Florida, have signed a minority report condemning the proposed compulsory purchase of silver under the Pittman Act. It was during the period that Mr. Glass was at the head of the Treasury Department that most of the 14,589,730 oz. of silver was used for subsidiary coinage.

EXTRACT FROM MINORITY REPORT

An extract from the minority report is as follows:

"Far from being in any respect injured by the policy pursued by the Treasury in execution of the Pittman Act, the silver producers have received a total bonus from the Treasury of approximately $58,169,950, representing the difference between the world market price of silver at the time of purchase by the Treasury and the $1 per ounce which the Treasury was required by the Pittman Act to pay. The Secretary of the Treasury gives it as his considered opinion that the passage of S. 756 would simply amount to 'a gift of $5,000,000 additional to the silver producers.' It would also compel the Treasury to purchase more than 14,000,000 oz. of silver for which the government has no need whatsoever. It would end up with compelling the Treasury to coin between 15,000,000 and 20,000,000 more silver dollars than the Treasury had when the original Pittman Act was passed. The passage of S. 756 would make Congress declare, in effect, that the Secretary of the Treasury has not properly construed or executed the plain purposes of the Pittman Act, which would be a sharp contradiction of the view held by the Secretary of the Treasury and the Comptroller General of the United States. It is the contention of the minority that, if the Treasury has not properly interpreted and executed the terms of the Pittman Act, any interest aggrieved or supposed to be affected by such interpretation should appeal to the courts, and not ask Congress to decree, at an expense of $5,000,000 to the American taxpayers, that such is the fact.

"This case cannot, perhaps, be more strikingly stated from the viewpoint of the minority than is done in the appended brief prepared by the Undersecretary of the Treasury."

A portion of the report of the Undersecretary to which the minority refers reads as follows:

TREASURY OPINION

"A bonus of $5,000,000 to the silver producers for the acquisition by the Treasury of wholly unnecessary silver should not be compelled by Congress. As a matter of fact, if the Pittman Act had not provided for the repurchase of silver, no harm would have been done to the American silver producers. The emergency in India was purely a war emergency and had to be settled at once, if at all. Unless the American silver dollars had been available, no silver could have been found in the world to accomplish the purpose desired by Great Britain, because the producers in this country did not have the silver and it was not available anywhere else in the world. Melting down the silver dollars, therefore, did not hurt the American silver producer. The requirement, however, that we repurchase silver at $1 an ounce has been of immense benefit to the American silver producer. Of course, the Treasury was able to purchase no silver at $1 an ounce when the market price was over that figure, but the silver producer took the world's market. It was only when the price of silver dropped below $1 an ounce that the American silver producer tendered silver to the Treasury. This was in May, 1920, two years after the passage of the Pittman Act. In acquiring the silver which the Treasury has purchased in compliance with the Pittman Act, the Treasury has paid a total bonus to the American silver producers of approximately $58,169,950, representing the difference between the world market price of silver at the time of the purchases and $1 an ounce."

EXTRACT FROM MAJORITY REPORT

A part of the majority report follows:

"While it is contended that the purchase of the silver bullion required by this bill would cost the Treasury $5,000,000 over and above the present market price, it must not be overlooked that as the Pittman Act requires this silver to be coined into standard silver dollars at 1.29, the actual gain to the Treasury is 29 per cent of the amount involved, or a total profit of $4,231,021.73. Obviously, those who framed and pressed for the passage of the act were determined to eliminate Treasury discretion, or at least to limit it to the making or not making of allocations. In other words, the act appears to the committee to have been an act to compel repurchase of domestic silver and not an act to conserve the resources of the Treasury. Whether it was wise or unwise to pass an act framed on this theory is not the function of the committee or the Treasury Department to decide. It is clear that the true intent and purpose of the act would be defeated if allocations under it were treated as revocable. Therefore the enactment of S. 756 is essential to the due and proper execution of the Pittman Act according to its true intent and purpose."

Amendment to War Minerals Act

Provision whereby war minerals claims may be carried to the Court of Claims is proposed in bills which have been introduced in both houses of Congress. The bills provide for the amendment of the original war minerals act by eliminating the provision that the decisions of the Secretary of the Interior are conclusive and final. Those who have received awards are required under the terms of the bill to post bonds when an appeal is made so that repayment to the government will be assured in the event the court finds that more was awarded than it holds to have been proper.

I. C. C. Refuses Permit for Railroad in Colorado

The Interstate Commerce Commission has "without prejudice" declined to sanction the building of the new railroad, 175 miles, from Craig, Colo., to Provo, Utah, believing that it was not really worth while, although Denver and Salt Lake City capitalists were backing it. On Feb. 27 the mining bureau of the Denver Chamber of Commerce passed a resolution condemning the action of the Commission.

Germany Increased Iron and Steel Production in 1925

Production of pig iron in Germany amounted to 10,176,700 metric tons in 1925, compared with 7,812,200 tons in 1924, according to the U. S. Department of Commerce. Raw steel production in 1925 was 12,193,500 tons, against 9,835,300 tons in 1924 and 11,466,000 in 1913.

It is noteworthy that though 203 of the 218 furnaces were in operation at the end of 1913, the close of 1924 found only 106 furnaces of the 215 furnaces available in operation, and at the end of 1925 only 83 of an available 211 furnaces were active.

England Increases Cement Production

A tremendous amount of work is being done at Northfleet on Thames-side, England, which will result in the largest cement factory in Europe being established there. Reconstruction of what is known as Bevans' works has been necessitated by the enormous demand for British cement both at home and overseas. To facilitate export direct from the Thames to any part of the world, a new deep-water wharf is being constructed, which will be able to berth ocean-going vessels up to 8,000 tons at any height of the tide. The reconstruction will result in the potential output of British cement being increased by more than 500,000 tons a year.

El Paso Mine to Resume Soon

Abner E. Woodward, of Denver, and associates will open the El Paso mine, in the Cripple Creek district of Colorado, during March. The mine has been closed since September, 1924. It is one of the largest properties in the district.

London Letter

By W. A. Doman

Special Correspondent

Difficult to Finance Panama Gold —Platinum Returns Disappointing

London, Feb. 23—Since last I mentioned the reported flotation of gold mines in Panama, nothing further has been heard of the matter. From what I gather indirectly it would appear that the promoters of the enterprise have been advised that they were asking for too much capital at the start. The capital, it was originally said, was underwritten to the extent of £2,000,000. I now understand that the first company to make its appearance will be of more moderate proportions and that the public will be asked to put up £500,000. As, however, this amount was said to be for prospecting and development purposes, the public might think that even this is high unless favorable data concerning the concessions are published. It is rather curious that after statements on the impending flotation some weeks ago, the matter should be hanging fire.

"It is an ill wind that blows nobody good." Though the mining companies on the Barrier Range, in New South Wales, are in difficulties owing to water famine, other companies producing lead should be placed in a favorable position. The Broken Hill companies were responsible for about 3,000 tons of lead weekly, and should this quantity be held up it is thought that the price of the metal will advance. So far it has not done so, but metal merchants, brokers, and producers are not disturbed, and the only observation made is that if the metal is not being produced consumers cannot have it and must wait or pay higher prices for the quantity available.

I understand that the Lena Goldfields has given instructions for the installation of a dredge which will be the most powerful in the world. It is said, however, that owing to transport difficulties it will not be in position and ready to get to work before 1928. Meantime, the company expects to maintain an output of about £70,000 monthly, of which one-third is expected to represent net profit.

The market was rather disappointed with the first return of platinum issued by the Transvaal Consolidated Lands Co. Tonnage was obtained from the Onverwacht Bonanza, and presumably was taken from the shaft sunk approximately in the center of the rich ore. The shaft is 6x4 ft., and down to the 200 level would contain about 400 tons of ore. The quantity dealt with was 367 tons, yielding an estimated amount of 156 oz. of platinum metals, equal to about 8.5 dwt. per ton. When the discovery was first made, the value for the 200 ft. was given as 22.7 dwt., so that there is a difference of 14.2 dwt. The question is being asked as to whether the assay tests were reliable or the extraction is defective. If the latter, then companies whose assays are only about 6 or 7 dwt. will have to find a superior method of extraction, so as to make the metal profitable on the large capital with which some of the companies have been endowed.

A résumé of the report of E. T. McCarthy, on the Chosen Syndicate, Ltd. (Korea), has been issued. He points out that last year roughly two-and one-half years' supply of ore to the mill had been opened up, notwithstanding that some 61,000 tons had been milled. The mine, with the exception of the ninth and tenth levels, had opened up really fine bodies of ore. With regard to the 9th and 10th levels, the lode in both had maintained its full width, but the pay shoots were broken up and short, as has occurred on the second and fifth levels. Mr. McCarthy states, however, that although both he and the general manager are naturally somewhat anxious as to the eastern part of the mine, they are confident that they will again pick up pay ore.

I understand that the François Cementation Co. has obtained two contracts in South Yorkshire. The company, it is understood, has accepted a contract for the sinking of a shaft at the Michael colliery of the Wemyss Coal Co. The new colliery will be on the shores of the Firth of Forth, and, being in close proximity to the sea, considerable water difficulties may be experienced. François Cementation has also obtained a contract in connection with the making of the new Mersey tunnel.

Mining Conditions Critical in Northern Spain

The mining crisis in the iron mines of the north of Spain continues to be as unfavorable as in former months, according to a report to the U. S. Department of Commerce. Some of the important mines have been closed since 1922, and some of them owned abroad, notably in England, have been sold. Others have worked only two or three days a week for several years. Exports of iron ore from Bilbao in 1925 were 1,462,864 metric tons compared with 1,514,130 metric tons in 1924. About 50,000 tons of iron ore was shipped to Asturias for Spanish metallurgical production.

German Company Organized for Exporting Platinum from Russia

The Precious Metals Trading Co., Ltd., has been organized in Berlin for the sale of platinum and its group metals (iridium, palladium, osmium, rodium, and ruthenium) produced in the Russian Soviet Union. The new company has made a working contract with the Soviet Government whereby it will export the above-mentioned metals from Russia to Europe and America, endeavoring to form direct connections with those enterprises which are dealing with platinum-metals, or employing these metals directly for technical or other purposes.

Russia's platinum industry has been built up again. Production of platinum and platinum-metals at present is concentrated in a state-trust, "Uralplatina" which is in a position to offer platinum of a standard grade of 99.5 to 99.8 per cent fine.

Johannesburg Letter

By John Watson

Special Correspondent

South African Mineral Production Exceeds Previous Year

Johannesburg, Feb. 2—The Department of Mines and Industries has just issued an abstract giving details of South African mineral production for the last two years, as follows:

	1925	1924
Gold (at standard price)	£40,767,982	£40,672,447
Silver	166,842	212.602
Osmiridium	170,995	102,886
Diamonds	8,198,368	8,029,466
Coal	3,880,442	3,830,163
Copper	495,797	511,844
Tin	298,973	304,108
Other minerals	272,577	294,790
Totals	£54,251,976	£53,958,306
With gold premium added		£57,786,224

A diamond of 125 carats, of which 60 carats are said to be very pure, was found recently on the Crown Diamonds mine, which is controlled by Lewis and Marks. It is described as a white-spotted stone, not yet valued, and is the largest diamond ever found on this mine, the previous best being a stone of 122 carats.

Exports of Minerals

A report recently issued by the general manager of the Union Railways states that, during November last, 654 tons of fluorspar was shipped from Ottoshoop, in the Transvaal, to America. Copper ingots weighing 484 tons were shipped from Messina to Lourenço Marques during November, compared with 390 tons in November, 1924. Tin ore weighing 123 tons was shipped in November from Warmbaths, Potgietersrust and Carolina, to Durhan, for shipment. On Nov. 5, 12,936 copper ingots were shipped through Algoa Bay (Port Elizabeth), on the "Clan Ross," for New York, from the Belgian Congo, followed by shipments of 6,140 tons to the end of December.

Lydenburg Platinum, Ltd., has taken over an option contract on the farm Watervaal No. 537 in the Rustenburg district.

The great Sennar Dam, recently opened in the Sudan, is designed to irrigate 300,000 acres. The enterprise is to be credited largely to the foresight of Frederick Eckstein, formerly of Johannesburg, who is chairman of the Sudan Plantation Syndicate.

On the Johannesburg Stock Exchange, during the last week, gold shares have been quieter. City Deeps declined about 3s. 6d. from 45s. 6d. to 42s. on a rumor of lower-grade ore to be worked. T. C. Lands were firm but quiet. Potgietersrust Platinums closed the week at 10s. 11d. (sales) on Saturday.

New Dredge for Nome, Alaska

The Goldsmith Dredging Co., of Spokane, has ordered a dredge of a daily capacity of 3,000 cu.yd. from the Yuba Manufacturing Co. It will be put into operation on the company's leases, near Nome, Alaska, as soon as it can be installed after the opening of navigation.

Canterbury Tunnel, Leadville, Penetrates New Veins

The Canterbury tunnel, the community development enterprise of Leadville, Colo., has apparently proven the correctness of the local mineralization theory in the exposure of good ore in the "white-lime" horizon. This ore is of smelting grade, and about two feet thick. It contains upward of 30 oz. silver per ton, with 30 per cent lead.

Such a discovery, even if made in the central portion of the old productive area, would have been significant, but coming as it does with the development of a region several miles northeast, it tends to prove the intervening area as a regular and an integral part of that mineralized field.

Other winter development in Leadville has produced normal results—that is, a maintenance of the usual amount of smelting ore; however, the definite tonnages of complex milling ores have been enormously increased as a result of the recent attention that has been given this class of ore requirement.

The marketing features promised, as a result of the custom concentrating plant recently installed, have added considerably to development of complex ore; hence the outcome of this milling effort is being watched with interest.

Butte & Basin Mining Co. Incorporated

The capital stock of the Butte & Basin Mining Co., recently incorporated in Montana, is 300,000 shares, par value $1. J. A. Shadoan, of Bozeman, is president; Eugene McCallum, of Butte, vice-president and general manager, and H. A. Bolinger, of Bozeman, secretary and treasurer. The company has contracted with the Butte Machinery Co. to furnish steam power plant, compressor, and hoist, and will actively develop the Haltie Ferguson group, consisting of five claims, on Cataract Creek, six miles from Basin. Lead-silver ore will be shipped to East Helena and zinc-silver ore to the Timber Butte mill.

Bohemia Mining Co. to Be Sold at Auction

The property of the Bohemia Mining Co. in Ontonagon County, Mich., will be sold at public auction April 8, in the village of Ontonagon. Bohemia has 960 acres of mineral-bearing land.

Diamond drilling was done on the property in 1910, and although several amygdaloidal beds were cut, the copper values did not warrant the sinking of a shaft.

Premier Power Plant Completed

The Premier Gold Mining Co. has completed and put into operation the addition to its power plant, which brings the total capacity up to 1,500 hp. This, with the recently installed Diesel-engine plant for use during periods of water shortage, assures ample power.

Recently the company opened a new shoot of high-grade ore from the No. 1 level. This shoot is in the northwest part of the property and is pitching toward B. C. Silver Mines territory.

Tintic Standard Largest Producer of Lead in Utah

TINTIC STANDARD leads in the production of lead in Utah, with Utah Apex second and Silver King Coalition third. Utah Copper ranked first in the production of copper, with Ohio Copper second, and Utah Apex third. Zinc producers ranked as follows: United States mine, first; Park-Utah Consolidated, second; and Utah-Delaware, third. Gold: Utah Copper, first; United States Mines, second; and Chief Consolidated, third.

First Unit of Noranda Smelter to Be 1,000 Tons—Smoke Trouble Forestalled

Developments at the Horne property of the Noranda Mines, of Quebec, have been so satisfactory that the company has decided that the first smelter unit shall be of 1,000 tons' daily capacity instead of 500 tons. In addition to the satisfactory developments on the third level, is the fact that the Waite-Montgomery and the Amulet are also showing up well and the enlarged capacity will no doubt be with a view to handling considerable tonnages of customs ore. A new company known as the Horne Copper Corporation has been formed to operate the Horne mine and smelter. This is a subsidiary of the Noranda.

It is apparent that the Horne smelter will be free from one of the troubles which most smelter companies have to face, and that is the smoke nuisance. Provision has already been made to protect the company in this regard by two amendments to the Quebec Mines Act, which have recently been passed. The first clause states that no person shall prevent or hinder the operations of smelters, refineries, or other works for treating ore, by means of an injunction or other legal proceedings. The recourse, if any, of any person prejudiced by such operations shall be confined to a claim for damages. The second clause states that no owner, tenant, or occupant of land in the Township of Rouyn and adjacent townships, and no holder of a permit to cut timber, may claim damages on account of the harmful gases and smoke produced during the operation of a smelter erected in the Township of Rouyn on a site approved by the Quebec Government; provided, however, that the plans for such smelter shall have been approved by the Superintendent of Mines.

Deep Mining to Be Tried

D. R. C. Brown, of Denver, Colo., major owner of the Aspen mine in Colorado, is planning the sinking of the Free Silver shaft on the Della S property from 1,200 ft. to 1,800 ft. Electric power, heavy pumping machinery, and much new equipment will be required. The cost is estimated at $300,000. Included in the development are the Aspen, Free Silver, Della S. Bushwacker, and J. C. Johnson.

Consolidated of Canada Initiates Pension Plan

The Consolidated Mining & Smelting Co. of Canada, ever on the alert to retain the interest of its employees in long service, has initiated a system of pensions, which will be available to employees sixty-five years of age who have been in the service of the company for fifteen years and those fifty-five years of age who have been employed continuously for twenty-five years. Pensions will range from $240 to $2,500 per year, and will be computed from the average annual payment received by the employees for the ten years previous to their retirement.

The pensions will be non-assignable, and their administration will be in the hands of a pension board to be appointed annually by the president and directors of the company. No inexperienced person entering the service of the company at more than thirty-five years old, nor experienced person of more than forty-five will be eligible for pensions. These age limits, however, may be made inoperative at the option of the company, in the case of persons possessing special technical skill.

Tailings from Granite-Bimetallic Mine May Be Reworked

The Granite-Bimetallic Mining Co. will soon lease its tailings piles, situated near Philipsburg, Mont. These tailings were accumulated a great many years ago from the concentrators and salt roasting and pan-amalgamation plants of the company, and comprise about 580,000 tons, assaying from three to seven ounces in silver per ton. Several years ago tests on the tailings were run by F. L[illegible]ii, who demonstrated their amenability to the cyanide process. In 1913 a syndicate was formed, consisting of Oscar Rohn, B. L. Dunshee, Barton Mitchell, John E. Rothwell, and Carl J. Trauerman, with a view to beneficiating the tailings. Various accumulations were thoroughly sampled and exhaustive cyanide tests run by Messrs. Rothwell and Trauerman in their custom laboratory in Butte. As satisfactory business arrangements could not be made with the company, the syndicate was dissolved.

United Zinc Takes Option on Vantage Mine

The United Zinc Smelting Corporation, controlled by Charles M. Schwab, the company operating in the Joplin-Miami field, has taken a ninety-day option on the Vantage Mining Co.'s No. 2 mine, which is south of Baxter Springs, Kan. The United Zinc is already operating the Royal mine, at Picher, Okla.

Robert Livermore Visits Denver

Robert Livermore, of Boston, president and general manager of the Smuggler-Union mine, who visited Denver late in February, says that with 300 men, the old Smuggler, which produced more than fifty million dollars in gold and silver, is putting out 19,000 tons a month, from which 2,000 tons of concentrates are obtained and sent to its smelter at Durango.

Societies, Addresses, and Reports

Canadian Institute Meets at Montreal

About 220 Members Present—Social Features a Great Success

By Edward Hodges Robie
Assistant Editor

MONTREAL, which has become perhaps the premier convention city of America, took its turn with Toronto and Ottawa, and became the mecca for the twenty-eighth annual meeting of the Canadian Institute of Mining and Metallurgy, held on March 3d, 4th, and 5th. Headquarters were at the Windsor Hotel, as usual, rather than the newer and bigger Mount Royal, or the aristocratic Ritz, and there would seem to be no reason to forsake the familiar surroundings, which are comfortable and well adapted to such conventions as this. The Canadian Institute has always been noted for the social features of its meetings, this one proving no exception. The technical sessions were, for the most part, well attended, but provided no food for an operating man, the papers presented being of a general nature or confined to descriptions of mining districts.

Next year's meeting will depart from the usual procedure. An invitation has been extended and accepted for the Empire Mining and Metallurgical Congress and the Iron and Steel Institute to come to Canada, so the regular Canadian Mining Institute convention will be held in conjunction with the visit of those organizations. This will probably be some time between the middle of August and the middle of September, 1927. It is thought probable that a transcontinental trip across Canada may be planned, with visits to the principal mining camps, and possibly technical sessions in some of the important cities en route.

Opening Session Devoted to Statistical Reports

The morning session of the Montreal meeting, following registration, was devoted to summaries of mining conditions during 1925 by government representatives from Ottawa and the provinces of Ontario, Quebec, British Columbia, and New Brunswick. The address to have been given by the retiring president, Thomas J. Brown, was omitted, owing to his absence from the city, as was also the address of welcome scheduled from the Mayor of Montreal. His secretary, however, made a few brief remarks.

S. J. Cook, of the Dominion Bureau of Statistics, commented on the printed "Preliminary Report of the Mineral Production of Canada" for 1925. The total value of metallic and non-metallic production was about $225,000,000, about $15,000,000 higher than last year, and within $3,000,000 of the record made in 1920; in fact, 1925 would have exceeded 1920 except for a change in the manner of calculating the value of nickel in matte, the full price of metallic nickel having heretofore been used. Greatly increased productions of gold, lead, and zinc were made; small improvements in nickel, copper, and cobalt; and silver about preserved its status quo in 1924. W. R. Rogers, in presenting Ontario Department of Mines Bulletin No. 55 on mineral production in that province in 1925, showed that output had set a new record in value, thanks to increased production of gold, nickel, and copper. Production of all of these metals is likely to increase further, but silver seems to have settled down to around 10,000,000 oz. a year, without much hope of an increase unless new districts are discovered. Gowganda is coming to life, it is true, and South Lorrain has produced around 3,000,000 oz. a year for the last three years, but Cobalt has receded from its old output in the 20,000,000's from 1908 to 1916, and now has to scratch around to turn out 6,000,000 oz.

A. O. Dufresne offered a preliminary statement of the mineral production of the Province of Quebec, which increased about 20 per cent in value over that of 1924, but did not come up to the boom year of 1920. The principal product is asbestos, an industry which now seems to have a much brighter future with the amalgamation of the producing companies. J. D. Galloway stated that no printed report of mineral production in British Columbia was available, but that it would be about $62,000,000, an increase of about 27 per cent over the figures for 1924, attributable to greater production of lead, copper, and zinc rather than to higher prices. Gold and silver production had decreased. There was, Mr. Rogers said, much more prospecting and development going on than in preceding years, and many prospects were being taken up. The principal features of the year were the enlargement of the Trail and Sullivan mine plants of the Consolidated, the activity of the Allenby Copper Co. near Princeton, and that of the B. C. Silver Mines, adjoining the Premier. W. E. McMullen made a brief oral report of mining activities in New Brunswick, where coal, oil, natural gas, and gypsum are the only mineral products.

Following the provincial reports, a short business meeting was held.

At the afternoon technical session on Wednesday, E. Godfrey gave an abstract of his printed paper, "Notes on Explosives," giving suggestions for improving practice. Major G. C. Riley, in commenting on the paper, emphasized the importance of safety in underground work, and said that accidents were too numerous in Canada. W. L. Goodwin narrated one of his early experiences. Then came one of the most interesting papers of the whole meeting, and a discussion that attracted an unusually large attendance.

A Tough Future for Canada

For two or three years, C. M. Campbell has taken violent exception to the "Inconceivable Canadian Wealth" propaganda of various persons who are booming the Canadian mining industries, his guns being directed to every one from the most insignificant stock promoter up to C. V. Corless, former president of the Institute. His contribution for this meeting was entitled "Canadian Natural Resources, Limited," and as the published paper omitted some of the hottest shots, he read much of his manuscript. In general, he quoted facts and selected statistics to prove that Canada's known and even probable mineral wealth was distinctly limited and that discoveries and development in the last few years were all out of proportion to what had been said about them and afforded no foundation for the rampant unbounded optimism. In the ensuing discussion, John A. Dresser thought that a little sedative to buoyancy was a good thing and said that he realized that everything was not perfect, but he was inclined to think that it was a good idea to keep heads up. Mr. Campbell, in his opinion, had been unjust to the railways, which had contributed greatly in an indirect way to the development of the country. Present production of minerals is insignificant, he thought, compared with what it will be fifty years hence. Frank E. Lathe considered that Mr. Campbell's statistics were no doubt incontrovertible, but that others could have been selected to prove that the future is rosy instead of black. W. L. Goodwin admired Campbell's "hard-hitting" and spoke of Canadians being wasteful in their use of natural resources, especially timber. E. H. Hamilton thought the people should realize that they must work for what they got and that there were too many stock jobbers offering specimen ore. Mathew Lodge, according to a statement in the Montreal *Gazette*, "did not think much of Mr. Campbell's views." As a matter of fact, he said that it was "the most damnable paper I ever heard"; that if it were read before a stock exchange it would kill all interest in mine financing, that he did not think it was correct in facts, and should not have been printed. J. W. Evans said that prospectors must have optimism, but that business demands cold facts. A. M. Campbell admitted his optimism and cited the great advance that had been made in northern Ontario in three decades. The knocking should stop. F. L. Garrison thought Canadian development had proceeded with speed and success, considering the difficulties. Conservation of resources had been a big problem in the United States, and he referred particularly to oil. In closing the discussion, the chairman, Thomas W. Gibson, emphasized the development in one generation of Ontario's mining districts, which he thought should hearten and encourage all mining men. Providence must be trusted for similar discoveries in the future. The general opinion seemed to be that Mr. Campbell was honest in his convictions, but that statistics could be quoted to prove anything and that he was unduly pessimistic.

"A Stock-taking of the Profession, With Special Reference to Exploration," by W. L. and W. M. Goodwin, was given in abstract by the senior author. In the discussion, the original discoverers in the Rouyn and Red Lake districts were mentioned, Ed. Hart having found the Horne claim, and Gus McManus, of Hearst, having discovered gold at Red Lake. More close co-operation with prospectors was urged, so that they might live and work more comfortably.

An evening session was devoted to a lecture by Dr. Frank D. Adams on "A Visit to the Gem Districts of Ceylon and Burma." The printed paper was illustrated with colored lantern slides.

In opening the second day's sessions, Frank E. Lathe presented a paper entitled "Have You a Research Problem?" describing the activities of the National Research Council at Ottawa, in the discussion of which, R. L. Peek suggested that more information on natural constants would be acceptable, as well as additional work on the constitution of mattes and slags. Mr. Lathe spoke of work being done on magnesite at Ottawa, by which it was hoped to make a product that would compete with that from Austria.

R. S. McCaffrey's offering was entitled "Research Co-operation Between University and Industry," descriptive of work done at the University of Wisconsin, which Mr. Lathe later said was of an extremely practical nature and might well be emulated in Montreal and Toronto. Ellis Thomson described a method of mounting polished sections of mill products: mounting them in sealing wax held in brass frames.

In the afternoon, Charles Camsell presented a paper on "The Influence of Minerals on Canadian History and Development," on which there was no discussion, and a paper by E. S. Moore, "A Lead and Zinc Deposit in Keewatin Iron Formation," was read in abstract by the chairman, Dr. W. A. Parks, no further comments being made. Paul D. Merica offered a comprehensive review entitled "The Nickel Industry" speaking particularly of the increased uses of nickel in industry and of the problems which have been solved. Several additional points were brought out in the discussion of this excellent paper. The last paper of the afternoon was on "Petroleum and Natural Gas Development in Alberta," by Charles C. Ross, presented by the author with the aid of lantern slides. There was brief discussion.

Smoker Attracts the Crowd

A special Institute luncheon was served Thursday at 1 o'clock, followed by a brief address. In the evening, the smoker attracted a large crowd, which had no fault to find with the entertainment provided. A trio of French-Canadian singers proved fully equal to the occasion, and a dissertation on petroleum was not too technical to be understood. Lantern slides were then shown, the subjects of which must have been taken from the pages of *Artists and Models* magazine, or one of its numerous sister publications, though the faces of prominent members of the Canadian Institute had been substituted, it apparently having been reasoned that the heads in the original art studies were of comparatively little interest, which was no doubt true. J. C. Beidelman made a few remarks to accompany each slide. As might have been expected, four policemen soon appeared, but the master of ceremonies was not to be found, and rather than arrest the entire audience, the chief of the raiding party sang a song. It was not till then, so it is said, that his three companions found that the raid was a joke. They were all real cops, supplied by the Chief of Police, with whom the Montreal members seem to be on particularly friendly terms. Refreshments followed, and then several good boxing bouts took place, winding up the smoker. It is said on good authority, however, that it was some hours later before the evening's pleasure was entirely concluded.

Attendance Dwindles Following Morning

At any rate, the number present at the technical session the next morning at 10 o'clock can be reported by your correspondent as not exceeding fifteen. The papers presented included "Resorption as an Agent in Freeing Hematite From the Grenville Granite Magma," by George W. Bain, on which there was no discussion; "The Goudreau Gold Area," by C. W. MacLeod and George S. Cowie, which aroused some interest among the geologists present; the "Red Lake Area of Patricia," by E. L. Bruce, which also caused brief discussion; and "Gold Mining in Nova Scotia," by J. C. Murray, which was largely a criticism of a report made by T. A. Rickard twenty years ago.

At the afternoon session, after announcement that Lewis Stockett had been elected president for the coming year, three papers were offered: "Manitoba Limestone From the Tyndall Area," by H. B. Lumsden; "Developments in Rouyn," by A. O. Dufresne; and "Some Recent Developments in Northern Quebec," by H. C. Cooke. A party of fifteen or twenty were taken in taxicabs to the oil refinery of the Imperial Oil Co. at Montreal East, where considerable interest was shown in the refining operations. An excellent supper was also provided in the company dining room.

The banquet on Friday night was largely attended and was most successful. It took the form of a dinner dance, and was enjoyed by everyone except those at the head table, who were prevented from getting onto the dance floor during the dinner by the long table in front of them, and were prevented from speaking afterward by the desire of the audience for wine, women, and song rather than after-dinner speeches. A few brief remarks were made which attracted no attention more than twenty feet away. The last speaker said he had prepared quite a paper on "The Mining Industry," but as the audience seemed in no temper to hear it he would sit down, following which the dancing immediately proceeded and continued till 2 o'clock.

Attendance Well Over 200

In addition to sixty-four registrations from Montreal and suburbs, large delegations came from Ottawa and Toronto, and the various mining districts were well represented. Those registering from out of town included:

Ottawa: Joseph G. S. Hudson, Arthur Buisson, J. McLeish, R. A. Strong, F. E. Lathe, W. B. Tirnen, V. L. Eardley-Wilmot, S. J. Cook, L. H. Cole, W. A. Johnston, W. F. James, E. M. Sheppard, F. J. Alcock, R. J. Traill, L. Airing, T. L. Tanton, M. E. Wilson, B. R. MacKay, J. F. B. Davies, W. E. Cockfield, Wyatt Malcolm, W. H. Collins, E. Poitevin, H. H. Claudet, Robert Harvie, B. F. Haanel, J. M. Forbes, Ernest Greene, and Charles Camsell.

Toronto: Ellis Thomson, H. T. Leslie, Joseph Errington, Thos. W. Gibson, P. G. Saterson, P. H. Austin, P. F. McCleary, C. T. Young, H. S. Southworth, J. T. King, T. E. Godson, Chas. L. Drury, W. U. Parber, G. C. Bateman, G. R. Mickle, C. Miner, F. M. Connell, L. J. Moore, T. H. Roadhouse, A. MacLean, W. L. Goodwin, J. S. Ness, C. D. Dean, W. K. McNeill, N. Leroi Crosby, W. F. Ferrier, Arthur Terry, Jr., W. R. Rogers, E. W. Todd, A. G. Burrows, I. W. Jones, T. L. Walker, J. A. Reid, and Alex. H. Smith.

Kingston: Stanley N. Graham, E. C. Boag, W. E. Bawden, W. B. Airth, Warren C. Davis, E. L. Bruce, J. C. F. Honsberger, W. W. Beaton, G. F. MacDonnell, and J. E. Jerome.

Cobalt: E. F. Armstrong, Arthur A. Cole, H. A. Burbank, B. F. Giumett, W. F. Fancy, F. H. Reid, Angus D. Campbell, J. G. Dickenson, and F. D. Reid.

Kirkland Lake: J. A. Hughes and T. J. Flynn.

Haileybury: Fred. G. MacLeod and Samuel Seaver.

Porcupine: Geo. E. Cole, V. H. Emery, S. A. Wockey and Austin J. Emgatuill.

United States: Waldemar Lindgren, G. W. Morrison, M. W. Maxwell, William T. May, L. D. Cooper, Forest Rutherford, F. Lynnwood Garrison, H. Ries, T. A. Gowling, R. S. McCaffrey, John V. N. Dorr, Norman Into, E. P. Mathewson, H. T. James, and E. H. Robie.

Asbestos district, Quebec: Norman R. Fisher, G. L. Burland, John J. Penhale, G. D. McLeod, and John Dixon.

Sudbury district, Ont.: P. E. Hopkins, S. J. Fitzgerald, D. Butchart, R. F. Slemark, E. A. Collins, and J. L. Agnew.

Maritime provinces: W. E. McMullen, J. G. Sipmell, M. Lodge, F. H. Sexton, H. M. Wylde, and J. E. McLurg.

Western Canada: Charles C. Ross, G. A. Vissac, A. Murburn, Harry T. Airey, R. M. McCaulay, V. Dolmage, W. W. B. Rony, G. M. Hutt, Lewis Stockett, L. Telfer, and H. B. Lumsden.

Sault Ste. Marie: Geo. S. Cowie and Geo. W. MacLeod.

Quebec: F. A. McLean, H. Freeman, J. A. Cole, W. P. Row, H. P. H. Brumell, J. MacDonald, Geo. W. Murphy, A. Edward Robitaille, A. O. Dufresne, Theo. C. Denis, and F. M. Passow.

Ontario: C. H. Buskard, R. A. Elliott, and H. A. McNally, of Deloro. R. L. Peek and H. W. Walter, Port Colborne. A. M. Campbell, J. H. C. Waite, J. G. Morrow, and R. E. Hore.

Altogether, about 220 were registered for the meeting, and in addition, several member brought ladies, for whom a separate program of entertainment was provided.

Men You Should Know About

David Hannah has been elected president of the South Wales Institute of Engineers.

M. C. Lake, geologist for the M. A. Hanna Co., has returned to Duluth from New York City.

J. V. W. Reynders has sailed for Europe, where he will investigate developments in manganese mining in the Caucasus.

W. A. Labarthe is leaving New York to join his father, **Jules Labarthe**, who is in the Caucasus engaged in manganese mining.

Donald MacAskill, superintendent of the International Nickel Co.'s smelter at Copper Cliff, Ont., is sailing for a vacation in Scotland.

J. W. Mangon, of the U. S. Geological Survey, has been transferred from the Utah district to the Washington (D. C.) office of the Survey.

Alexander Deussen, of Houston, Tex., vice-president of the Marland Oil Co., of Texas, attended the recent meeting of the A.I.M.E. in New York.

Fred G. Farish, of Flushing, Long Island, N. Y., has been appointed general manager of the Rico Mining & Reduction Co., operating at Rico, Colo.

Colonel Henry H. Armstead has returned to New York from Kaslo, B. C., where he has recently made inspections and laid out further development of his properties in that section.

Robert A. Kinzie, mining engineer og San Francisco, recently left for Mexico City, from which point he will go to Bolanos and then return after examining mining properties.

R. M. Atwater, Jr., of New York City, president of the North Butte Mining Co., will visit Butte, Mont., next month to superintend operations at the North Butte and Tuolumne copper mines.

Dr. Charles Schuchert, of New Haven, Conn., professor emeritus of geology, Yale University, gave a lecture on "Shore Lines in Texas" before the Houston Geological Society, Houston, Tex., on Feb. 26.

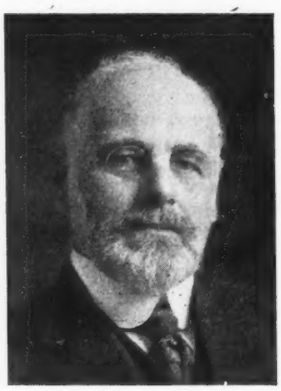
H. Roger, chief metallurgist of the Lubumbashi smelter, at Elisabethville, in the Belgian Congo, one of the properties of the Union Minière du Haut-Katanga, is making a tour of the smelting plants of the Southwest.

Victor Dolmage, head of the Vancouver branch office of the Canadian Geological Survey, has left for Montreal and Ottawa, where he will confer with the head office as to field work in British Columbia for the coming season.

Hugh Shirkie, of Terre Haute, Ind., was on March 8 elected president of the American Mining Congress. He succeeds the late Colonel D. B. Wentz. Mr. Shirkie war formerly president of the Indiana Bituminous Coal Operators' Association.

E. P. Mathewson will leave for Tucson, Ariz., next month, where he expects to make his future home. He has accepted a position as professor of mining administration at the University of Arizona, and will work in close co-operation with the mining companies of the state.

Theodore P. Colvin, a mining and civil engineer representing American platinum interests, at the end of January visited the new osmiridium field at Adams River, Tasmania, Australia. He expressed the opinion that this will prove to be the largest known source of osmiridium in the world, and that the field will have a long life.



Prof. J. F. Kemp

Prof. James F. Kemp and his wife will sail for Europe on the *Patria*, leaving New York on March 31. Professor Kemp is chairman of the delegation appointed by the A.I.M.E. to attend the International Geological Congress which meets at Madrid on May 10.

E. H. Robie, assistant editor of *Engineering and Mining Journal-Press*, attended the annual meeting of the Canadian Institute of Mining and Metallurgy last week. Other engineers from New York included **E. P. Mathewson**, **Forest Rutherford**, and **John V. N. Dorr**. Mr. Robie's report of the congress will be found on page 460 of this issue.

Dr. William Otis Hotchkiss, president of the Michigan School of Mines, addressed the Colorado Engineering Council, Denver, on Feb. 24. Talking about mining in Michigan and in Colorado, he said that the prices of copper and iron, the principal metals, have not risen in price like lead, zinc and silver, therefore the mining men of Colorado have a very bright future. While in Colorado he was the guest of **Dr. M. F. Coolbaugh**, president of the School of Mines, Golden, Colo.

Dean Frank H. Probert, of the College of Mining of the University of California has returned from a trip to the East, where he attended the annual conference of the American Institute of Mining and Metallurgical Engineers. He was also present at a special conference called by that group at which forty representative engineers and professors met to discuss ways of stimulating the interest of young men in engineering colleges. From New York, Dean Probert proceeded to Washington to attend a conference held there by the U. S. Bureau of Mines. Attendance at the hearings of the Oil Conservation Board in Washington was also included in Dean Probert's eastern schedule. **Prof. L. C. Uren**, expert on petroleum engineering, also attended the hearings at the personal request of the Secretary of the Interior.

Obituary

William Kennedy, chief geologist of the Lone Star Gas Co., died at his residence in Fort Worth, Tex., on Feb. 23, at the age of sixty-seven. Mr. Kennedy was one of the pioneer petroleum geologists of Texas and among the first to work in the Gulf Coastal salt dome district.

Thomas A. Arthur, resident of Montana for twenty-eight years and leader in mining, real-estate, business, political, and oil activities, died in Phoenix, Ariz., on Feb. 25, after a protracted illness. He was long active in politics, both state and national, and was chairman of the Democratic State Central Committee in 1914 and 1915. In late years, Mr. Arthur confined his activities almost entirely to oil activities in Wyoming and Montana, being associated with Judge Freeman when the latter headed the Mutual Oil Co., especially during the development of the Cat Creek oil field, in Fergus County, Mont. At the time of his death, Mr. Arthur was business representative of the Continental Oil Co. in Montana.

Domingo de Orueta, one of the most distinguished mining engineers of Spain, died at his home in Madrid on Jan. 14. He was a man of large wealth, conducting metallurgical and manufacturing enterprises in Gijon, on the north coast of Spain. At the same time he was a member of the Spanish Geological Survey (Instituto Geológico de España) and had published several of its most masterly monographs, including the studies of seismic disturbances in the Sierra Nevada, and an elaborate investigation of the uplift known as the Serranía de Ronda, where a vast peridotite massif has intruded Cambrian limestones and later rocks, and produced a series of interesting "thimble deposits" of commercial iron ores. Assuming that peridotite should mother platinum, he systematically investigated the area with reference to that metal, and proved small commercial and larger semi-commercial accumulations of platinum in the gravels. He was one of the greatest petrographers so far developed in Spain. His treatises on the petrographic microscope and methods are among the most noted in the world. At the time of his death he was engaged upon a study of the igneous rocks of the Peninsula of Guelaya near Melilla, Morocco, including the area of the famous Minas del Rif, in which the U. S. Geological Survey had assisted by sending him an elaborate collection of a series of similar intrusives and eruptives of the same age in this country.

Recent Technical Publications

Reviews, Abstracts, and References

Ore Deposition at Randsburg, California

Geology and Ore Deposits of the Randsburg Quadrangle, California. Bulletin No. 3, California State Mining Bureau, San Francisco. By Carlton D. Hulin.

A Review by J. E. Spurr

THE GEOLOGY of a well-known and interesting mining area is skillfully described in this publication. Perhaps the best-known mine in this district is the Yellow Aster gold mine, but there are a number of others.

A variety of rocks occur in the quadrangle — igneous, sedimentary, and metamorphic—and in age they range from Archean to recent. The Archean rocks are gneisses and schists, overlain by Paleozoic sediments. A batholith, believed to be an offshoot phase of the Sierra Nevada granodiorite, and of late Jurassic age, has intruded these rocks. Varieties of this intruded magma in the Randsburg quadrangle are classified as granite, quartz monzonite, and quartz diorite. A variety of the last-named shows included angular schist fragments, whose alteration may be traced by transitional stages to rounded "orbicles" with granitic texture and the composition of a quartz diorite, to stages "where only the faintest concentration of dark minerals remains to suggest the former presence of an orbicle." Those geologists who construe replacement phenomena of included fragments in a mineral vein as evidence against the ore-magma theory may well ponder on this complete replacement of schist fragments by the rock magma. Indeed, Dr. Hulin believes that the batholithic invasion in general, was accomplished more by assimilation (that is to say, by replacement) than by forcible injection, although the latter process was important. Limestone has been far more resistant to assimilation and replacement than the other rocks. This batholith, it may be remarked, has no connection with the ore deposition of the region.

Intrusive Rocks and Ore Deposits of Tertiary Age

Intrusive rocks of Tertiary age—probably Upper Miocene—also occur. These are: (1) Rhyolite-latite dikes, pipes, and sills, the later dikes of the series becoming more basic; (2) diabase and basalt dikes. Flows and dikes of andesite are later and of probable Early Pliocene age; and still later is Pliocene-Pleistocene basalt. Important faulting has occurred in the Quaternary.

The ore deposits are Tertiary, and divisible into three successive stages of a single epoch: (1) tungsten, (2) gold, and (3) silver.

The tungsten deposits are fissure veins. They were formed in the Miocene, close to the surface, by ascending solutions. Post-mineral faults cut the deposits; the earlier faults of this series were contemporaneous with the ore deposition.

The (later) gold ores occur along lines of pre-mineral faulting, and are cut by later faults; they are fissure veins and impregnations, and are free from silver. In the Yellow Aster mine, ore deposition has been directly controlled by structural conditions, which determined the upward movement of the auriferous solutions.

Still later, silver deposits occur, in veins of two systems, one striking north and the other northeast, following older fault lines. The ore minerals are miargyrite, stylotypite, pyrargyrite, and proustite, in a gangue of fine-grained quartz, with calcite and chalcedony. Deposition of the silver ore has been directly due to structural control in the California Rand silver mine, where the flat fault zone has stopped the upper movement of ore solutions.

A diabase dike cuts the tungsten deposits in one mine, while in another locality tungsten veinlets are reported to be later than the diabase dikes; but the gold veins and the silver veins are all later than the diabase intrusives, as well as the rhyolite-latite dikes.

Tungsten Deposited in Open Fissures

The tungsten veins have been deposited in open fissures, with little or no replacement. Unreplaced fragments of wall rock are imbedded in the ore. The chief vein materials are quartz, scheelite, calcite, and sporadically stibnite. Scheelite and quartz were the first minerals crystallized; afterward came stibnite and pyrite, and then calcite and other earthy carbonates. Dr. Hulin is inclined to believe that deposition took place from stagnant (not circulating) solutions.

The gold veins carry as principal minerals quartz, arsenopyrite, and subordinate pyrite. Small quantities of galena are of later deposition. Last of all was the gold. Some of the deposits show gold and sulphides without quartz. Replacement of rocks by ores was an important process. A close relation between the tungsten veins and the gold veins is indicated. Both the tungsten and the quartz veins were clearly formed close to the surface, whence the author concludes that they were deposited at low pressures and low temperatures, a conclusion to which I will refer later.

The silver veins, like the gold ores, but unlike the tungsten veins, have been deposited largely by replacement, with fissure filling. The chief minerals are quartz, chalcedony, miargyrite ($Ag\ Sb\ S_2$), stylotypite [$3(Cu_2\ Ag_2\ Fe)\ S.\ Sb_2\ S_3$]; pyragyrite ($Ag_3\ Sb\ S_3$), proustite ($Ag_3\ As\ S_3$), pyrite, and arsenopyrite. The association of silver and antimony is therefore noteworthy. The ore averaged 50 oz. in silver and $3 in gold per ton. There is more arsenic than antimony in the ore. Angular schist fragments, without trace of replacement, occur in the fissure veins. The deposition of most of the quartz preceded that of the metallic minerals. The early solutions were rich in silica, iron, sulphur, and arsenic; the later ones in silver, antimony, and sulphur.

From the data the author concludes that all the three stages—tungsten, gold, silver—occurred during a comparatively short period in early Upper Miocene time and all came from the same magmatic reservoir as the Tertiary rhyolitic and diabasic intrusives.

Summarizing this unusually keen and careful analysis of a mining district, I have but one objection to raise—the assumption that because the ores were formed near the surface they were therefore formed at a low temperature. This is a widespread and persistent conclusion, but is an unwarranted one, as I have shown; for rocks very near the surface during periods of volcanic injection may be far hotter than rocks at great depths under more ordinary conditions. That shallow depth has meant low temperature, during periods of ore deposition, (an assumption which has been especially emphasized by Lindgren in America, and has indeed been made one of the bases for his classification of ore deposits) is as fundamental an error as has been made in our more recent literature of ore deposition.

With this mental barrier removed, we perceive that the tungsten ores, followed by arsenical gold-quartz ores, represent the regular zones of ore deposition at relatively high temperatures and therefore in rocks heated by volcanic invasion. This conclusion finds local confirmation in the diabase dikes which are in part younger than some, at least, of the tungsten veins and older than all of the immediately succeeding gold veins. Surely the diabase dikes, even though demonstrably "deposited" so close to the surface, were not "low-temperature" deposits, compared with diabase dikes in depth! The well-established sequence, tungsten-gold, indicates a falling temperature, and the position of the basic dike invasion between these two, and partly contemporaneous with the tungsten, adds another bit of evidence to my published argument that basic magmas congeal at the same general temperatures as ore deposits[1] at temperatures around 400 to 500 deg. C.

The silver stage represents evidently a still cooler period. Indeed, these partly chalcedonic quartz veins of the silver stage, characterized by combinations of silver and copper with arsenic and antimony, clearly belong to the upper silver zone, called the "principal silver zone"—zone G—by the reviewer.[2] Between this zone G and the zones A and B, represented by the tungsten and gold-quartz veins of the region, the copper, zinc, and lead zones are not represented.

A gap in mineralization, accompanying the general fall in temperature, is thereby indicated, separating two successive injection episodes of ore magma: the first, of tungsten passing over, with falling temperature, to gold; and an independent later one, when the temperature was still lower, and the silver ores were introduced.

The Early Miocene sequence of magmatic injection, which included the

[1]Bulletin of the Geological Society of America, 1925. Vol. 36, pp. 545-582.
[2]The Ore Magmas, Vol. II, p. 704.

various ores, may thus be diagrammatically summarized, adapting the arguments and diagram of the reviewer from an earlier article above cited[3]:

	Rock Magmas	Ore Magmas
700 deg. C.		
600 deg..	Rhyolite Latites	
500 deg.	Diabase	Tungsten-Quartz Gold-Quartz
400 deg.		
300 deg.		Silver-Quartz

For the rest, the evidence of sharply timed injections—not age-long upbuilding—of concentrated and stagnant solutions, fits in admirably, in my opinion, with the Ore Magma theory. Some of the ores are replacments, but some, as described, are true veindikes, including most of the tungsten ores and part of the silver and of the gold ores. Among many evidences of this is that shown at a point where a silver vein cuts a

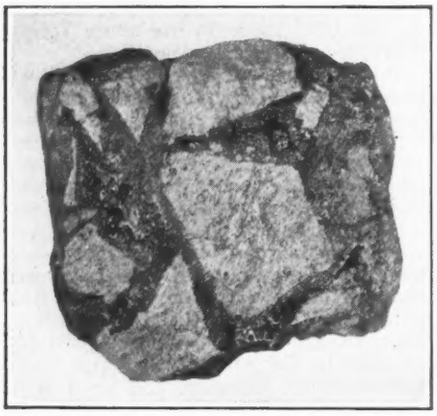


Fig. 1—Angular rock inclusions in silver ore

gold vein in the California Rand mine. Fragments from the gold vein, carrying $5 to $75 (per ton) in gold and only an ounce or two in silver, are cemented in the silver vein. And the accompanying figure (Fig. 1), copied from the frontispiece of the little book, showing angular inclusions, in the silver ore, of schist with the schistosity oriented at random, and the central spaces between the fragments occupied by drusy cavities, is a similar indication. And the fact that in both the gold and the silver ores, the metallic minerals tend to crystallize in the veins later than the quartz, or even to form veins and orebodies separated from the quartz, illustrates one of the basic phenomena of ore magma crystallization, as I have many times pointed out.[4]

The limited vertical extent of nearly all the orebodies, whether of tungsten, gold, or silver, compared with the horizontal extent, furnishes, moreover, evidence of the applicability of the Upper Pressure Limit, or Dumping Horizon explanation advanced by the reviewer.[5]

The tungsten ores usually extend in depth only 100 or 200 ft. — the oreshoots are generally roughly triangular in form, the apex being downward. Some of the oreshoots do not reach the surface, although Dr. Hulin believes that the present surface lies only a few hundred feet below that of the time of the introduction of the tungsten veins. And the same is stated of the gold deposits, which, in no case, have persisted beyond a depth of a few hundred feet. The silver deposits were formed under similar very superficial conditions, and while in the single important silver mine the ore has been followed to the eleventh level, the amount of ore is contracting. In the case of the

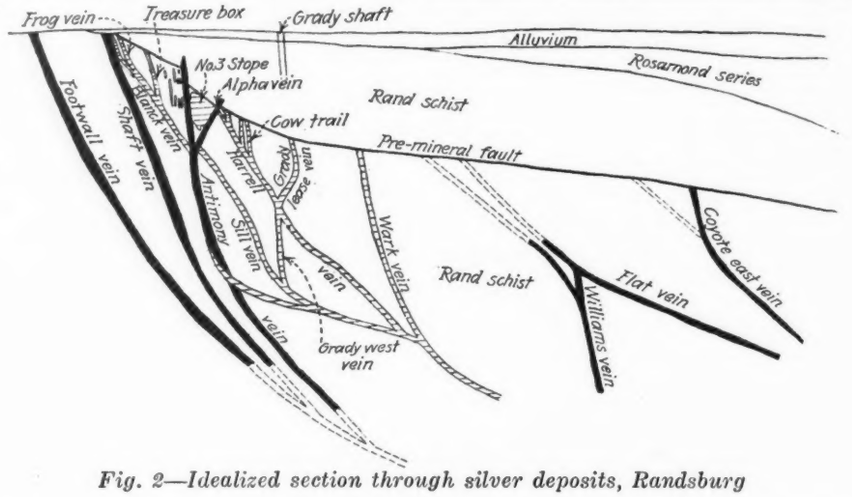


Fig. 2—Idealized section through silver deposits, Randsburg

silver ores, all the veins terminated above at a pre-mineral flat-lying fault or crushed zone which furnished the local relief of pressure (Fig. 2); and a similar upward termination of at least the most important group of gold veins —and impregnation gold ores as well— that of the Yellow Aster mine, was furnished by pre-mineral faults. "And in consequence," Dr. Hulin writes of the Yellow Aster mine, "we find orebodies developed which reach their maximum size and also terminate immediately below the low-dipping pre-mineral faults, and we find these orebodies gradually decreasing in size in depth, in some cases actually feathering out downward within the limit of the mining operations which have already been carried on."

Although the author explains the control of the upper limit of vein formation, both in the case of the gold ores and of the silver ores, by the damming back of the ore-solutions by fault-gouge, I am inclined to the explanation which I have indicated earlier in the paragraph—that is, that expansion of ore-magma gases on encountering the flat overlying faults brought about consolidation of the ore magma from that point downward. In either case, no prettier example of the hair-trigger conditions which determine consolidation close to the surface has been described.

Asphalt — The chapter on "Asphalt and Related Bitumens," a separate of "Mineral Resources, 1924," by K. W. Cottrell, nine pages, has been issued by the U. S. Bureau of Mines. Obtainable for 5c. from the Superintendent of Documents, Washington, D. C.

Chimneys—J. G. Mingle has had published in *Power* (Feb. 16, 23, and March 2) a series of three articles on chimney design. (New York; price 15c. each.) The first article discusses chimney draft; the second tells how to figure the capacity of a chimney; and the third is a study of the sizes of chimneys and the most economical ones to build. The same author has also recently had a book published (Combustion Publishing Corporation, New York; price $3.50) on the "Design and Capacity of Chimneys."

German Publications — Recent German publications of interest to mining engineers include: "Die oberschleische Zinkindustrie," in the Feb. 1 issue of *Metall und Erz* (Berlin), discussing the zinc industry in Upper Silesia; and two booklets published by Wilhelm Knapp, Halle (Salle), these being parts 2 and 3 of "Abhandlungen zur praktischen Geologie und Bergwirtschaftslehre." Part 2 is by Prof. V. Pollack, entitled "Die Beweglichkeit bindiger und nicht bindiger Materialien," 139 pages, price 9.80 marks, and Part 3 is entitled "Die Anwendbarkeit der geophysikalischen Lagerstättenuntersuchungsverfahren insbesondere der elektrischen und magnetischen Methoden," by Rudolf Krahmann, 40 pages, price 2.5 marks. The last named discusses the development of geophysical mine research, taking up the specific gravity method, the magnetic method, the electrical resistance and conductivity method, and the measurement of the spread of artificial earthquakes.

Roasting — In the Jan. 5 issue of *Chemical Engineering and Mining Review* (Melbourne, Australia; price 12d.) Alfred T. Fry has a four-page article on "The Roasting of Copper Concentrate," discussing some operating considerations in the preparation of copper concentrate for leaching. Close control of the furnace is, of course, more necessary than in roasting for smelting.

Washington Geology — Professional Paper 140-A, of the U. S. Geological Survey, obtainable free of charge, contains a 16-page paper entitled "Geology of the Latah Formation in Relation to the Lavas of the Columbia Plateau Near Spokane, Washington," by J. T. Pardee and Kirk Bryan.

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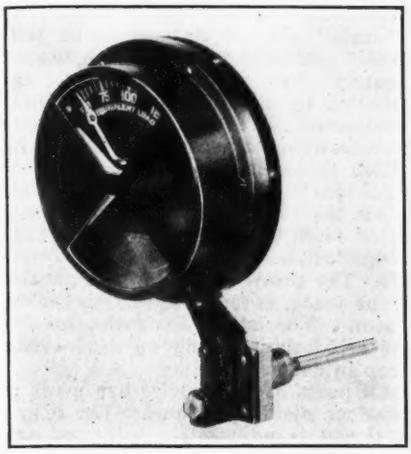
[3]Bulletin of the Geological Society of America, 1925, Vol. 36, p. 564.
[4]See *Econ. Geology*, June-July, 1925, Vol. XX, No. 4, p. 397.
[5]The Ore Magmas, Vol. II, pp. 550-704.

New Machinery and Inventions



The Transformer Watchman

This little instrument which may be attached to the side of the transformer shows the percentage of capacity which the unit is carrying and also indicates when the full capacity is exceeded. This latter indication constitutes virtually a danger signal.

New Thermotel Registers Transformer Conditions

Accurate knowledge of the conditions under which electrical equipment is operating is always important. The type B-2 thermotel as manufactured by the General Electric Co., of Schenectady, N. Y., is a new load indicator for 60-cycle, 2,300-volt current. It is applicable to the subway type distribution transformers ranging in size from 15 to 200 kva. inclusive. It is similar to the thermotel for the pole type of transformers and was designed as a convenient and reliable means of making load surveys.

This instrument is designed to evaluate the sum of all of the several variables on which the output of a transformer depends. These include the kva. rating of the transformer, the load, the duration of the load, and the temperature of the surrounding air, usually referred to as the ambient temperature. The percentage of available transformer capacity being utilized is also indicated.

This instrument shows when the transformer is underloaded as well as overloaded, together with the load conditions existing at the time of resetting. Furthermore, it exposes an easily distinguishable danger signal when safe load conditions are exceeded. An important detail of its construction is its ability to accurately differentiate ambient temperature variations.

This device consists essentially of two thermometers connected in series. One is of the capillary tube type and is immersed in the oil of the transformer; the other is of the bimetallic type and is located in the external case and acts as a corrective for the ambient temperature. The combination of the two makes it possible to actuate an index and danger signal.

The external case is of brass, finished in black japan and thermally insulated from the radiant heat of the transformer by a metal screen and air space. This case is riveted to a bronze casting through which the capillary tube passes. Installation requires only the removal of the lower oil-sampling plug, after which the thermotel, which is provided with the necessary fitting, is screwed into place. An auxiliary sampling plug is provided on the instrument to permit the checking of the oil level in the transformer.

The index is of the maximum reading type and records the maximum percentage of the transformer's capacity that has been utilized since the last resetting, the scale being graduated to read between 50 and 100 per cent of transformer capacity. The semaphore indicating an overloaded transformer is normally not visible until 100 per cent of the capacity has been exceeded. When this occurs, the semaphore drops into view.

Soldering Iron Improved

A new soldering iron of light construction, designed to heat up quickly, is being marketed by the General Electric Co. This iron is made in standard sizes ranging from ½ in. to 1¼ in. tip. Power consumption ranges from 70 watts for the smaller iron for light and intermittent use, to 350 watts for the larger size on heavy duty. The irons for heavy duty are provided with radiating stands for the purpose of maintaining the iron at the correct operating temperature when temporarily not in use. The rapid rate of initial heating is brought about by unusually good heat conduction between the heating element and the copper tip. Heat from the tip is prevented from reaching the handle by means of a special mechanical construction between the two, this being in the form of a spiral made from a steel rod. This also provides a rigid connection between the handle and tip.

Instead of mica, usually used for an electrical insulator in the heating unit of soldering irons of this type, the heating unit has an insulating powder so highly compressed that it becomes a good heat conductor and will withstand temperatures of more than 2,000 deg. F.

The iron is provided with a standard lead and connection plug. Its construction is simple, parts are few, and all parts are equally replaceable.

Helical Gear Drive Used on Ball Mills

Twenty 8-ft. Marcy ball mills equipped with Nuttall helical gears have been built by the Hardie Tynes Manufacturing Co., of Birmingham, Ala., for the Anaconda Copper Mining Co.

German Instrument Maker Opens Texas Office

The Askanie Werke A. G., of Berlin-Friedenau, Germany, makers of geophysical instruments for exploring mineral deposits, have opened an office in the United States at 805 Keystone Building, Houston, Tex.

A New Recording Pyrometer

Charles Engelhard, Inc., 30 Church St., New York City, has recently brought out the Type S recording pyrometer illustrated in Figs. 1 and 2, in which have been embodied a number of improvements, principal among these being the mercury contact switch shown in Fig. 3.

The outer case of the instrument is made up of two castings, the back half, which forms the base of the instrument, being made from cast iron and the front half or cover, from cast aluminum. The mechanism is assembled on a sub-base that is secured to the casing by four bolts.

The galvanometer-moving system

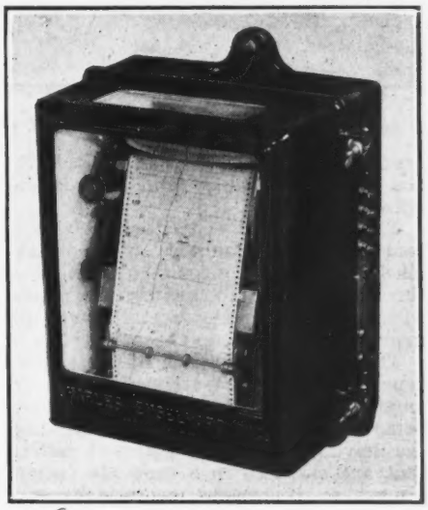


Fig. 1—Type S recording pyrometer

which is mounted on the back of the sub-base responds to the electromotive force applied to the terminals of the instrument, and its deflection from the low-scale division is a measure of the electromotive force, which in most cases is calibrated directly in terms of temperature. A clock mechanism drives the chart at a fixed rate of speed. A depressor bar above the pointer is operated intermittently from the power unit. When the depressor bar is low-

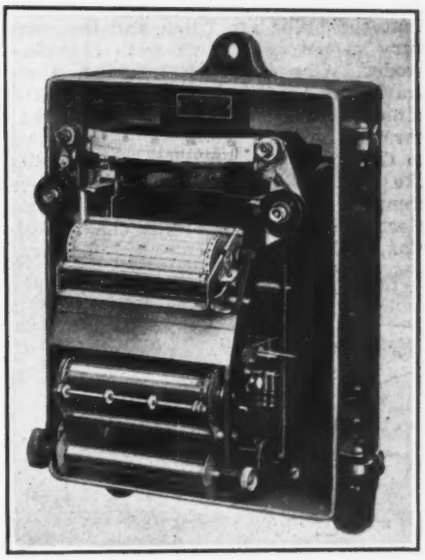


Fig. 2—View of pyrometer mechanism

The Market Report

Copper and Zinc Steady; Lead Weaker

New York, March 10, 1926—Copper has sold in larger volume than last week, and at somewhat higher prices than a week ago. Demand for zinc has been poor, but no further weakening in the price from recent low levels has taken place. Lead is distinctly weaker, and tin and silver are substantially unchanged.

Copper Around 14.25c. Delivered

The copper market was very active on Thursday and Friday, a large tonnage being sold for delivery both in the Middle West and the East. Most of this went at 14⅛c. delivered in Connecticut and ⅛c. higher further west. Saturday, after having sold freely in the preceding two days, an effort was made to mark prices up ⅛c., and a fair tonnage was sold at the higher levels. Most of the demand had been satisfied by Monday, however, and the market was quiet until today, when a good tonnage was sold at 14⅜c. Middle Western points, and at slight concessions from 14¼c. in the East. Most of the demand has been for metal for April shipment, though a fair tonnage has also been booked for May.

The foreign market has been quiet and the European news has been discouraging. Prices have ruled at 14.35@14.45c., c.i.f.

The lack of a good export demand may cause a slight further increase in stocks when the next statistics are released in spite of continued excellent domestic consumption. The reorganized export association is progressing as smoothly as anticipated, and some definite announcement may be made within two or three weeks.

Daily Prices of Metals

Mar.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L.
4	13.925	62.875	63.875	8.75	8.40	7.40
5	13.95	63.00	64.00	8.70@8.75	8.40	7.50
6	14.00	63.00	64.00	8.70@8.75	8.40	7.50
8	13.95	62.75	63.75	8.60	8.35	7.45
9	13.925	63.00	64.00	8.55@8.60	8.25	7.40
10	14.00	63.25	64.25	8.40	8.20@8.25	7.35
Av.	13.958	62.979	63.979	8.629	8.338	7.433

*The prices correspond to the following quotations for copper delivered: March 4th 14.175c.; 5th, 14.20c.; 6th, 14.25c.; 8th, 14.20c.; 9th, 14.175c.; 10th, 14.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Mar.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
4	58¾	59¾	65½	292¼	282¼	32 1/16	32 5/16	34 15/16	35
5	59⅛	60	65¾	293½	283⅞	32⅜	32 9/16	35 1/16	35⅛
8	59	60	66	292½	282¼	32⅛	32 5/16	35	35
9	59	60	66	292⅝	282¾	31⅝	31⅞	34 9/16	34 9/16
10	59	60	66	293½	284¼	31⅝	31 15/16	34½	34 9/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Mar.	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
4	4.85½	65¾	30¼	84s11d	8	4.85⅜	66	30⅜	84s11d
5	4.85⅜	66	30⅜	84s11d	9	4.85⅝	66⅜	30 9/16	84s10½d
6	4.85⅜	65¾	30 5/16	.....	10	4.85¾	66	30⅜	84s10½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

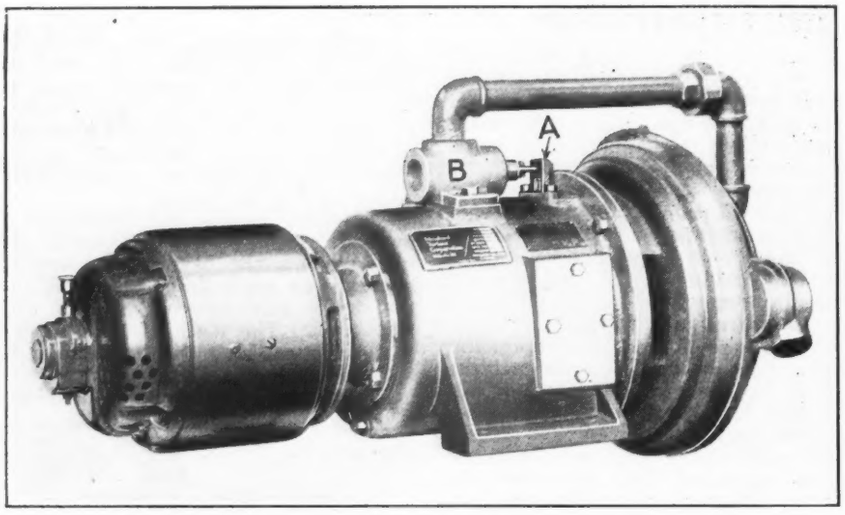
Further Weakness in Lead

The lead markets are all lower than a week ago, and buying, particularly in the St. Louis district, is unusually scant. After three reductions last week the American Smelting & Refining Co. made two further cuts, the first from 8.75c. to 8.60c. on Monday, March 8, and the second from 8.60c. to 8.40c. today. This makes a net cut of 75c. per hundred since Feb. 24 and brings the price to the lowest point recorded since July, 1925. When the Smelting company made its cut on Monday, a fair volume of business made its appearance, but this has disappeared since. The market may fairly be described as in the buyers' hands for the time being. A year ago during the early months of the year the New York price fell persistently from 10½c. to 7⅞c. in the middle of April. Apparently, buyers are speculating on the possibility that a somewhat similar course will be taken by the market this year. Producers, however, are not heavily stocked with unsold metal for March and April, and if buyers persist in holding off, they are likely to find a shortage of much-needed spot metal in the course of a month or two. The leading producer in the West quoted 8.25c. St. Louis yesterday and today, and sales have been made in the outside market at 8.20c. Antimonial lead is in good demand, bringing from 9c. to 9.30c. delivered in New York, depending on the analysis.

Zinc Market Quiet

Sales of zinc have been much smaller than usual in the week ending today. Prices reacted upward somewhat on Thursday and Friday, possibly owing to the slight improvement in London, but the strength has not been maintained the last three days, and today quotations are back to the level of a week ago, around 7.35c. The monthly statistics of the American Zinc Institute are as follows, in tons of 2,000 lb.:

Stock, Feb. 1	14,300
Produced	53,237
Shipped	47,196
Stock, Feb. 28	20,341
Shipped from plant for export	1,164
Stored for customers	516
Retorts operating	87,651



Emergency lighting unit designed for automatic starting

ered, the pointer presses the inked ribbon against the chart and records the pointer's position.

The power unit is controlled from a contact switch mounted on the clock. Each time that a circuit is established through this contact switch, the power solenoid is drawn down and drops the depressor bar against the pointer.

The recording chart is of the ribbon type and approximately 100 ft. in length, the over-all width of the chart being 6⅝ in. This chart is held against the driving drum by a series of rollers that are mounted in a separate frame, hinged so it can be swung outward while the rolls are being changed. The driving drum for the chart is connected to the gear train by an adjustable clutch.

The electric clock for the unit is designed for alternating current and is of the Warren type. The mercury contact switch previously referred to is furnished on the multi-record instrument and forms part of the power unit. This switch consists of levers mounted on a spindle and spaced from one another. To the lower ends of the levers is attached a small glass tube containing mercury and sealed in electrodes. The normal position of the levers is such that the bulbs are tilted and the mercury is not in contact with the electrodes. Opposite each lever on a revolving spindle that is connected to the pinion of the power unit is a stud that throws the lever forward when turned to the right position. This action tilts the switch bulb so that the mercury completes the circuit between the two electrodes as shown in the closed position, in Fig. 3.

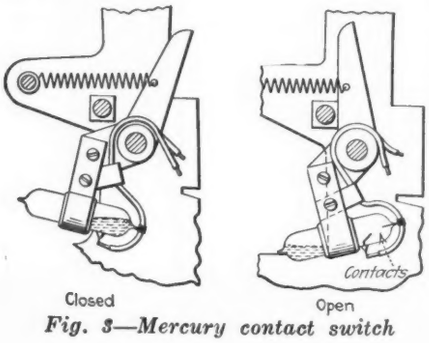


Fig. 3—Mercury contact switch

An Emergency Lighting Unit

A turbo-generator set in sizes from ½ to 10 kw., designed especially for use as an emergency lighting unit for the power station, is a recent development of the Standard Turbine Corporation, Scio, N. Y. The unit is arranged to start automatically when for some reason the regular light supply on the station fails, automatic starting being accomplished by means of an electrically operated shutoff valve in the turbine steam line.

The set is similar in construction to the regular line of small lighting sets built by this company except for the governor, which is of special design and which operates in the oil space of the bearing pedestal. The steam governing valve *B* is fastened directly to the top of the turbine and connects with the governor through the lever *A*. The generator is made an integral part of the turbine, which tends to reduce the over-all size for a given capacity.

Automatic Re-centering Bearings for Electric Motors

Many of the troubles experienced with electric motors are the result of bearing wear permitting the rotor to rub on the stator. To insure a continuous uniform air gap in motors, the Howell Electric Motors Co., of Howell, Mich., has brought out a complete line of motors with anti-friction bearings, in which any looseness in the bearing, caused by wear or otherwise, is instantly and automatically taken up, so as to keep the rotor of the motor continually centered. This is done by using a Timken tapered roller bearing, shimmed with a fluted wire spring which acts as a compression spring.

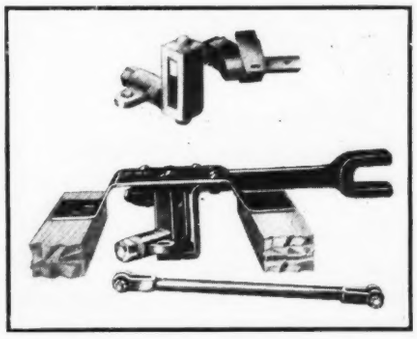
The inner race or cone of the roller bearing is fitted on the shaft with a light press fit. The outer race or cup is fitted into the housing of the motor end bell with a sucking fit which allows creeping of the outer race. The spring is held tight against this outer cup by the outer grease cap; pushing the cup tightly against the rollers and keeping the bearings tight at all times. This type of bearing is put in each end of the motor. The roller bearing is made of nickel-molybdenum steel.

Low Parallel-Throw Switch Stand Is Adjustable

An inexpensive, double-bearing, parallel-throw switch stand called the "Durabil" that is claimed to be positive in action and smooth in operation recently has been developed and patented by the L. A. Green Railway Equipment Co., of Pittsburgh, Pa. The accompanying illustration shows this switch throw in some detail.

All parts of this switch stand are below the housing and thus are protected from damage. The entire stand is compact, rising only 2 in. above the ties. The throw of the lever is parallel to the track, assuring safety to the operator. The stand is non-automatic and self-locking, being on dead center when in normal position.

All parts of this device are made of rolled or die forged steel. The length of throw is adjustable, being capable of variation from 3 to 5 in. by the mere transference of shims or washers Thus this stand can be used not only with switches of differing lengths of throw but by changing the position of a shim or two it can be adjusted for worn switch points, thereby obtaining positive contact of these parts. The connecting rod may be either made rigid or be fitted with a spring.



Details of the switch stand

It is built entirely of forgings no cast parts being employed. It is low and compact and the movement of the hand lever is in a direction parallel to the track assuring safety. Actual length of throw may be adjusted to suit local requirements.

Trade Catalogs

Vibrating Screens — Catalog No. 50 of the Universal Vibrating Screen Co., Racine, Wis., describes the company's line of vibrating screens. Vibration in these screens is developed by means of two off-center weights.

Electric Furnaces. — Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, England, in a circular call attention to the line of Wild-Barfield electrical furnaces exhibited by them at the Birmingham Fair from Feb. 15 to Feb. 26.

Blowers.—Bulletin 21 B of the Connersville Blower Co., Connersville, Ind., covers Victor rotary positive blowers.

Pulverized Coal—Catalog U-1, recently issued by Combustion Engineering Corporation, New York, describes the "C-E Unit System" for burning pulverized fuel by the direct fired method in all boiler plants operating units from 150 hp. up.

London's Influence on Domestic Lead and Zinc Prices

By Arthur B. Parsons
Assistant Editor

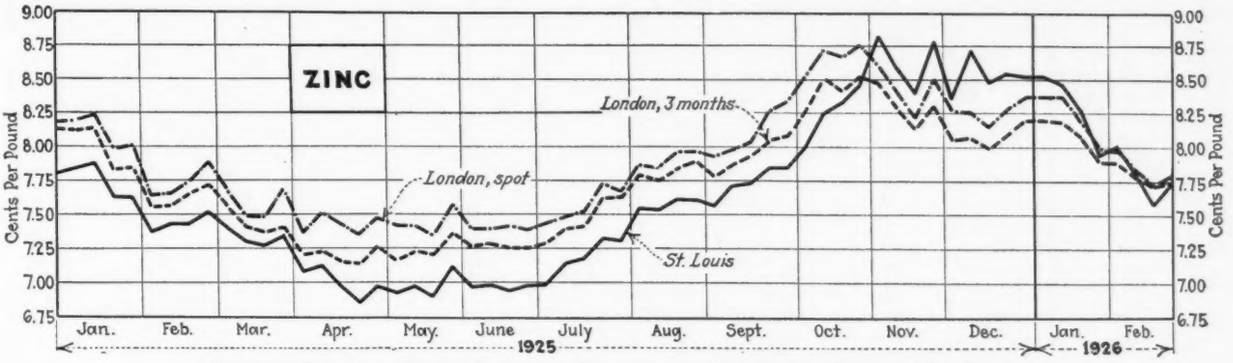
AGITATION in European metal circles, apropos of the proposed organization of a strong Copper Export Association in the United States, has focused attention on the inter-relation of the London and the New York or St. Louis metal markets. The rather startling regularity with which crests and troughs in the price curve for electrolytic copper in New York coincided with those of Standard in London during the last fourteen months was shown in the market section of the *Journal-Press* last week. The graphs appearing on this page disclose a similar tendency with respect to lead and zinc. Each curve represents the prices on successive Wednesdays in cents per pound. The London quotations, originally made in pounds sterling per long ton, are adjusted for the ruling price of sterling exchange and reduced to the equivalent in cents per pound.

Under what may be described as "normal" conditions, Europe should import an average of from 5,500 to 6,500 tons of zinc per month from the United States. The delivery cost from St. Louis to European ports is almost exactly 40c. per hundred pounds. Accordingly, the London price should periodically rise to a level slightly more than 40 points above St. Louis, so as to make European business attractive to American producers. The curves show that the spread was definitely in favor of selling in London in April, May, and June, and again in September and the first part of October. However, the markets were in approximate balance until October, and foreign sales were made regularly by American producers.

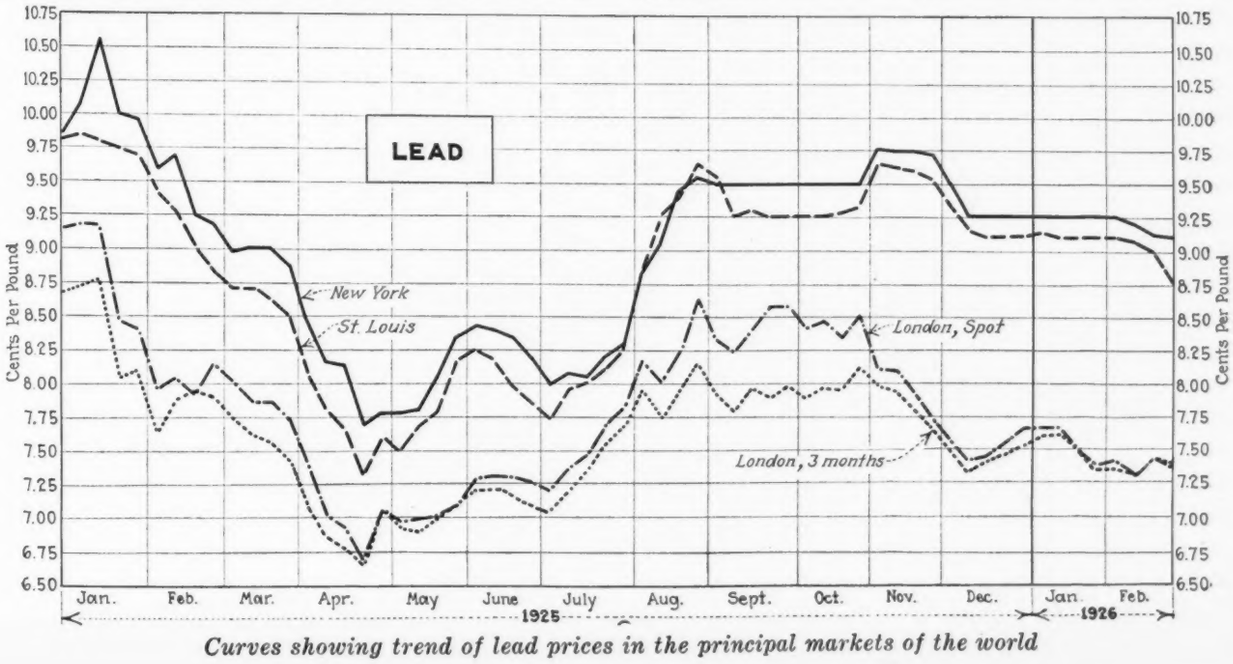
The upward trend from midyear to October was primarily the consequence of exceptional consuming business in the United States, accompanied by a sharp decrease in stocks. Germany also was a buyer. The crossing of the curves early in November resulted from the reversal of the German position, due to bad financial conditions. Instead of buying, Germany sold Silesian zinc in the London market. For a time the United States carried the domestic market, but, at the first of the year, it was believed either that St. Louis must come down or that London must move up. London continued to decline, however, and the consequence was the more precipitate drop of the St. Louis quotation as indicated on the graph.

An example of the importance of a prosperous Europe to the welfare of American industry is this: Consumption of zinc in the United States, France, and England is in reasonably satisfactory volume; in Germany, alone, it is at low ebb, but as a consequence of the position in a single country the world market is depressed. A similar contraction in German buying was a big factor in the decline of the early months of 1925.

The extremely wide fluctuations in the lead market are characteristic of a commodity of which world consumption approximates closely the potential current supply. Com-



Curves showing fluctuations in the zinc market in London and St. Louis



Curves showing trend of lead prices in the principal markets of the world

The most encouraging feature of these data is the reduced number of retorts operating, which should cause a decline of about 5,000 tons in monthly production. High-grade zinc is 9@9¼c. delivered.

Tin Stronger

Tin has improved in the domestic market in step with higher prices in London. Part of the buying has been speculative and part on behalf of consumers. Tuesday was the most active day. The April position is at a discount of about ⅝c. and May of 1c. Tin of 99 per cent grade is quoted uniformly at 1c. under the price of Straits.

Silver Unchanged

Higher Shanghai silver rates brought China into the market again as a buyer, with consequent better prices for San Francisco delivery, and this improvement was reflected by an upturn in the New York market. London reports the Indian bazaars also as buyers, but any local inquiry from this source has not been apparent. On March 10, China's position was reversed, and these sales caused a drop in the London quotation of 3/16d. New York also declined, but the reaction here was not so marked, as sellers were somewhat disinclined to meet the lower rates after the recent rise.

Mexican Dollars; March 4th, 50⅝c.; 5th, 50⅜c.; 6th, 50⅝c.; 8th, 50¾c.; 9th, 51⅛c.; 10th, 50¾c.

Francs Lower

A net decline in French francs during the week ending today is the feature of foreign exchange. Closing cable quotations on Tuesday, March 9 were: francs, 3.67¾c.; lire, 4.01¾c.; marks, 23.81c. Canadian dollars are quoted at ⅝ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 per long ton.

Antimony—Per pound, duty paid, New York: Chinese brands, spot, 20¼@19½c. April arrival, 19½@18⅝c. Cookson's "C" grade, spot, 23¾c. Market quiet and prices mostly nominal.

Bismuth—$2.70@$2.75 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. Market slow. London, 1s. 9d. for Australian metal.

Iridium — $250@$275 per oz. for 98@99 per cent. Nominal. London, £70@£75 for 99.5 per cent.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent); London, £170@£175 per long ton.

Osmium—$90@$95 per ounce; London, £23½@£25½.

Platinum — $112 per ounce refined officially quoted. Sales also at $106@$109. Crude, $106@$107. London, £23@£24 for refined; crude, £21@£22.

Quicksilver—Per 75-lb. flask: $88@$89 for spot and forward. San Francisco, $88.67. London, £15.

Ruthenium — $75@$85 per ounce; London, £16½@£19½.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Palladium, Radium, Rhodium, Selenium, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of March 6.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $12@$12.50; Western scheelite, $12.50@$13. Domestic demand very light, and prices largely nominal. European demand fair.

Chrome Ore, Iron Ore, Manganese Ore, Molybdenum, Tantalum, and **Vanadium Ores** are unchanged from quotations in the March 6 issue.

Zinc and Lead Ore Both Lower

Joplin, Mo., March 6, 1926

Zinc Blende	Per Ton
High	$56.60
Premium blende, basis 60 per cent zinc	$49.00@$50.00
Prime Western, basis 60 per zinc	$48.00
Fines and slimes, 60 per cent zinc	$47.00@$45.00
Average settling price, all zinc	$51.25
Galena	
High	$117.80
Basis 80 per cent lead	$110.00
Average settling price, all lead	$116.54

The last two days of this week gave producers a changed perspective regarding the market prices of both zinc and lead. That confidence which has been determinedly displayed this year succumbed to pessimism as the metal markets were further lowered by producers of metal in an effort to find a market for an increasing tonnage reported to be accumulating. Those who disposed of large tonnages of lead concentrates when prices began to decline feel that they properly sensed conditions. Producers still holding lead now think they will necessarily continue holding until May, chancing a rising market then.

An unusually open winter, that has made it possible to prosecute prospect and development work at nearly all times, greatly augmented the winter output. Mill building was scarcely deterred at any time, and the number of new mines opened and mills started exceeds the record of any previous winter months.

Stocks of zinc are nominal, all sold, with contracts being made in advance of the production.

Platteville, Wis., March 6, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$ 52.50
Lead Ore	
Lead, basis 80 per cent lead	$110.00

Shipments for the week: Blende, 1,049 tons; lead, none. Shipments for the year: Blende, 8,830; lead, 220 tons. Shipments for the week to separating plants, 1,867 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the March 6 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3c. per lb. Small sales. London, £14@£15 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from prices in the March 6 issue.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the March 6 issue.

Ferromanganese—Domestic and foreign, 78@82 per cent, $100 per gross ton. The Electro Metallurgical Co., controlled by Union Carbide & Carbon Corporation, announces that its new price on ferromanganese is $100 a ton duty paid tidewater. This level has been met by the rest of the trade. In trade circles it is believed that the reduction was caused by the competition of ferromanganese produced from ore imported from the Russian fields.

Metal Products

Rolled Copper—Sheets, 22¾c.; wire, base price, 16¼c. per lb.

Lead Sheets—Full, 12¼c. per lb.; cut, 12½c.

Nickel Silver—29¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 20½c. per lb.; rods, 17½c.

Zinc Sheets—12c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite** are unchanged from prices in the March 6 issue.

Steel Trade Good—Pig Iron Quiet—Coke Steady

Pittsburgh, March 8, 1926

The steel market is in a sound position—better than was expected in the forepart of January. Although production has just made a new high record for a four-month period, the trend seems to be upward.

The stiffening tendency continues in plate and sheet prices, other lines having shown no appreciable change for many weeks.

Pig Iron — The Pittsburgh-Valley market continues quiet, the last fortnight having been particularly dull. Prices are fully maintained: Bessemer, $21; basic, $20; foundry, $20.50.

Connellsville Coke—The market for standard grades has held very steady, at $3.25@$3.50 for furnace and $4.50@$5 for foundry. There is some accumulation of coke below standard, despite the sharp curtailment by operators who were making coke for the Eastern market. Blast-furnace demand is insignificant, contracts for the quarter covering requirements.

paratively inconsequential changes in production or consumption have a magnified influence on the price. For instance, the persistent decline up to mid-April was caused in large part by the slackening of purchases in Germany. Subsequently the sensitive market shot up, primarily as the result of a shipping strike in Australia, which interfered with deliveries of Australian lead to Europe, beginning in July. The graph shows the result clearly. The backwardation for a time reached the unusual figure of about 0.8c. per pound, equivalent to more than £3 per long ton, showing that the strong demand was for spot delivery. During September and October, London bid for Mexican ore-lead and got it. That it did not have to pay more, was probably because of the policy of the leading American producers to hold down the price and avoid a runaway market.

The United States tariff on lead, of course, plays an important rôle in determining the relation between the London and American markets. Domestic mine production normally is inadequate to meet the demand, so that the deficiency must be made up from foreign supplies. The duty on lead in ore is 1.5c. per pound; that on lead in bullion is 2.125c. Ores can be smelted or bullion refined in bond in the United States, so that an equivalent quantity of metal can be exported and the duty "drawn back." Mexican lead plays the part of adjusting the demand between Europe and the United States. Three kinds of Mexican lead may find a market either in this country or abroad. Ore lead, or lead from Mexican ores smelted in the United States, pays a duty of only 1.5c. However, this is based on the assay content of the ore, and, as only about 92 per cent is usually recovered, whereas 99 per cent of the duty paid is subject to draw-back on exports, the effect is to make the duty equivalent to about 1.6c. The cost of shipment abroad averages 25 points, varying with the particular destination, so that when the current price in New York is 1.35 above London parity, ore lead normally should enter the domestic market. Ordinary bonded Mexican bullion lead, refined in the Eastern seaboard refineries in the United States, would enter the domestic market if the margin were about 1.875c.—the duty of 2.125c. less the ocean freight.

Refined Lead Last to Reach U. S. Market

The third class is Mexican lead refined in Mexico. Since this bullion may be shipped directly to Europe at approximately the same cost as applies to shipments from Mexico to New York, the margin against New York is the full duty of 2.125c. The Peñoles company, which has the only refinery in Mexico, is the only producer of this class of lead. Although it does not show on the graph, there have been days since the first of January, 1926, when lead of this kind was profitably imported at New York. It was partly to prevent such lead from entering the United States that the Smelting company made price cuts in late November and early December, and again in February. This is one of the ways in which London has a direct influence on the domestic market. The New York price, as indicated in the graph, usually has been far enough above London to attract Mexican bonded bullion lead since mid-November.

A notable fact is that whereas an appreciable contango on standard copper in London has existed during the entire period covered by the curves, an exactly opposite condition had prevailed in both lead and zinc, until the last week in February. This backwardation on spot as compared with 3-months' deliveries doubtless has reflected the prevailing feeling that current prices for the two metals were comparatively high.

These graphs, supplementing that for copper published last week, offer an interesting picture of the dependence of the European and American markets on each other. They seem to show conclusively that a strong domestic market cannot endure without adequate foreign support. Or, to state the case in broader terms, industrial health in Europe is a strong factor in the prosperity of American mining.

Auction Sales of Mining Stocks

The following stocks and bonds of mining companies were sold recently at auction in New York:

$20,000 Estabrook Gold Dredging Co., 1st 6s, 1927	$60
$3,000 San Geronimo Mines & Metals Corporation, debenture 8s, 1941	12
7,000 Midwest Butte Development, par $1	50
$3,500 Midwest Butte Development, 6 per cent notes past due convertible into stock at par	50
3,000 Midwest Butte Development Co., par $1	20
21,000 Jib Consol. Mining, par $1	5
	5

Company Reports

Iron Cap Copper Co.

During the fourth quarter of 1925 the Iron Cap Copper Co. produced from its mine in the Globe district in Arizona 776,011 lb. of copper, 32,421 oz. of silver, and 22.2 oz. of gold. Income for the quarter was $104,557.81, and expense was $54,120.45, leaving a gain of $50,437.36.

Attorneys advise that the suit of the Arizona Commercial Mining Co. against the International Smelting Co. was dismissed on Feb. 8. This action had to do with the treatment of Iron Cap ores, and its effect was to close the Iron Cap mill on June 29, 1925. The mill is now being made ready to resume work.

St. Joseph Lead Had Best Year in History

The report of the St. Joseph Lead Co. for the year ended Dec. 31, 1925, shows earnings after deducting all charges for depreciation, depletion and reserve for federal taxes, to be $9,573,146.32. The mines and mills in St. Francois County, Mo., produced 4,628,746 tons of ore and 247,106 tons of concentrates.

There was produced by Kansas Explorations, Inc., a subsidiary of this company, from its properties in southwest Missouri, Kansas, and Oklahoma, 264,702 tons of ore 1,898 tons of lead, and 15,855 tons of zinc concentrates.

Smelter production was 154,627 tons of pig lead. Sales of pig lead for the year amounted to 154,654 tons.

In December the Mississippi River & Bonne Terre Railway, one of the subsidiaries of the company, disposed of all of the stock of the St. Francois County Railroad Co. at a net loss of $266,951.60.

St. Joseph Lead Co.
Consolidated Balance Sheet, Dec. 31, 1925

Assets

Capital assets		
Ore reserves and mineral rights, including appreciation arising from revaluation	$30,370,196.93	
Less—reserve for depletion	16,107,250.50	
		$14,262,946.43
Buildings, plant and equipment	$14,791,958.91	
Less reserve for depreciation	3,160,669.05	
		11,631,289.86
Railroad property and equipment	$3,753,679.85	
Less reserve for depreciation	619,206.64	
		3,134,473.21
		$29,028,709.50
Investments		
Sundry securities and loans	$733,883.71	
Mine La Motte (prospecting expenses)	231,182.09	
		965,065.80
Current and working assets		
Inventories:		
Lead and zinc on hand and in process	$932,392.04	
Materials and supplies	1,822,875.46	
	$2,755,267.50	
Notes and accounts receivable	2,527,109.58	
Marketable securities	7,297,894.07	
Cash in banks, on hand and in transit	2,696,663.26	
		15,276,934.41
Deferred charges		
Prepaid insurance and taxes		248,940.43
		$45,519,650.14

Liabilities

Capital stock		
Authorized—2,000,000 shares of $10 each	$20,000,000.00	
Issued—1,996,722 shares of $10 each	$19,967,220.00	
Less in treasury—46,332 shares of $10 each.	463,320.00	
	$19,503,900.00	
Script outstanding	1,188.50	
		$19,505,088.50
Minority Interest in subsidiary companies		
Capital stock, par value	$235,950.00	
Proportion of surplus applicable thereto	105,815.37	
		341,765.37
Funded debt		
Current liabilities:		
Accounts payable	$1,983,784.18	
Wages accrued	127,836.14	
Interest and property taxes accrued	54,650.49	
Provision for 1925 federal income tax	1,926,695.97	
	$4,092,966.78	
Dividends declared, payable quarterly in 1926	5,851,170.00	
		9,944,136.78
Reserve for contingencies (Including federal taxes of prior years)		1,415,917.99
Surplus, per statement attached		14,312,741.70
		$45,519,650.14

Ray Production 12,000,000 Lb. Copper per Month

Ray Consolidated Copper Co., operating the Ray mine, in Arizona, and the Chino mine, in New Mexico, produced copper as follows during 1925:

1925	Net Pounds Copper Produced	Average Monthly Production
First quarter	36,242,239	12,080,746
Second quarter	34,700,792	11,566,931
Third quarter	35,082,897	11,694,299
Fourth quarter	36,050,783	12,016,928

During the quarter a total of 1,561,000 tons of ore, averaging 1.40 per cent copper, was treated at the concentrators, compared with 1,554,800 tons, averaging 1.42 per cent copper, during the preceding quarter. This is equivalent to a daily average of 16,967 tons in the current quarter, as against an average of 16,900 tons in the third quarter.

Average mill recovery was 83.19 per cent of the copper contained in the ore milled, corresponding to an extraction of 23.37 lb. of copper per ton of ore treated, compared to the recovery of 81.88 per cent and extraction of 23.31 lb. in the preceding quarterly period.

The cost per pound of net copper produced from all sources, including depreciation of plant and equipment and all fixed and general expenses and after crediting gold and silver and miscellaneous earnings, was 11.40c., compared with a cost, similarly computed, of 11.41c. per pound for the previous quarter.

The financial outcome for the quarter, set out in comparison with the results for the two preceding quarters, is shown in the table in the next column.

	Fourth Quarter 1925	Third Quarter 1925	Second Quarter 1925
Operating profit from copper production	$1,204,973.45	$1,167,730.27	$815,155.71
Miscellaneous income, including value of precious metals	100,223.85	70,998.09	72,040.98
Total operating income	$1,305,197.30	$1,238,728.36	$887,196.69
Depreciation	209,096.64	236,463.18	234,268.41
Net income	$1,096,100.66	$1,002,265.18	$652,928.28

Superior & Boston Copper Co. Smelter Returns $133,396

During the fiscal year ended Sept. 30, 1925, the Superior & Boston Copper Co. shipped to the smelters 14,432 dry tons of ore, averaging 3.75 per cent copper and 10.31 oz. silver, containing 1,081,472 lb. of copper and 148,830 oz. silver; this brought $133,396.15 in net smelter returns, after deducting freight and smelting charges, or an average of $9.24 per ton, according to E. G. Deane, manager.

Income Account for Year Ending Sept. 30, 1925

Receipts		
Ore sales	$148,611.83	
Ore in transit	14,869.96	
		$163,481.79
Profit and loss		
Interest on deposits		4,218.28
Account Call No. 11, collected		76,393.00
		$244,093.07
Disbursements		
Expended on account of general development		$293,677.08
General expenses		21,728.32
Machinery and equipment		38,501.20
		$353,906.60

Imports and Exports of Ores and Metals in January, 1925 and 1926

Compiled by the U. S. Department of Commerce

In pounds unless otherwise specified

Imports

	January, 1925	January, 1926
Antimony		
Ore { Gross weight	173,235	143,161
Ore { Antimony content	110,134	111,491
Liquated, regulus, or metal	832,587	3,190,513
Copper		
Ores, copper content	8,303,379	13,094,320
Concentrates, copper content	2,163,010	798,461
Regulus, coarse metal and cement copper	763,361	64,240
Imported from		
Spain	401,209	1,703,550
Canada	4,942,710	7,551,165
Mexico	3,519,950	692,921
Cuba	.....	.....
Chile	1,309,814	3,633,199
Peru	40,327	48,236
Other countries	1,015,740	327,950
Unrefined, black, blister, and converted copper in pigs, bars, and other forms	15,858,870	36,354,032
Imported from		
United Kingdom	1,250,189	2,465,441
Canada	3,709,998	2,806,365
Mexico	3,681,048	10,391,283
Chile	3,934,732	2,591,192
Peru	3,282,903	5,202,044
Portuguese Africa	.....	12,897,294
Other countries	.....	413
Refined copper	4,493,754	13,786,315
Old and clippings for remanufacture	1,153,365	532,178
Composition metal, copper chief value	894	10,980
Brass		
Old and clippings for remanufacture	1,693,684	443,501
Lead		
Ore and matte	9,695,195	7,917,254
Bullion or base bullion	12,864,185	8,556,203
Pigs, bars, other forms and old	1,000,189	1,568,169
Manganese ore, long tons	12,829	41,998
Pyrites, long tons	9,235	63,210
Tin		
Tin ore, tons	5	15
In blocks, bars and pigs	19,519,305	15,749,339
From		
United Kingdom	2,746,690	4,831,600
British Straits Settlements	14,003,044	9,211,956
China	33,615	.....
Dutch East Indies	56,037	.....
Hongkong	833,933	448,671
Australia	369,781	151,320
Other countries	1,476,205	1,105,792
Zinc		
Ore—Free	421	.....
Dutiable	480,134	425,113
Blocks, pigs, and other forms	25	2,445

Exports of Copper, Lead and Zinc

	January, 1925	January, 1926
Copper		
Ores, concentrates, matte and regulus	190,030	3,265
Refined in ingots, bars and other forms	90,404,114	62,416,511
Exported to		
Belgium	7,627,274	6,976,403
France	9,634,840	22,672,521
Germany	26,490,067	6,374,771
Italy	12,412,648	4,570,373
Netherlands	10,011,731	2,490,495
Spain	426,635	728,800
Sweden	2,105,100	986,898
United Kingdom	16,904,961	12,516,368
Other Europe	3,216,804	352,400
Canada	1,271,449	2,043,601
China	.....	504,000
Japan (including Chosen)	223,994	1,307,803
Other countries	78,611	892,078
Old and scrap copper	1,674,487	469,797
Pipes and tubes	170,443	247,066
Plates and sheets	936,669	671,723
Rods	4,213,626	2,922,116
Wire	1,825,295	568,000
Insulated copper wire and cable	1,157,232	1,135,013
Lead		
Pigs, bars and other forms		
From domestic ore	227,607	56,693
From foreign ore	17,582,772	12,194,699
Exported to		
Belgium	851,529	1,232,362
France	2,664,630	3,136,723
Germany	6,215,897	1,075,580
Italy	279,247	896,209
Netherlands	672,252	167,435
United Kingdom	6,173,978	3,473,316
Other Europe	481,907	336,700
Argentina	15,170	87,216
Brazil	392,092	448,180
Japan (including Chosen)	.....	448,106
Other countries	63,677	949,565
Other lead manufactures	1,441,913	3,072,075
Zinc		
Ores and concentrates	7	7,553
Dross	1,346,691	2,304,830
Zinc (spelter) in slabs, blocks or pigs	26,686,681	1,445,107
Exported to		
Belgium	570,511	.....
France	4,513,706	874,310
Germany	3,047,776	86,696
Italy	336,086	280,249
Netherlands	1,116,828	.....
United Kingdom	16,006,348	.....
Other Europe	123,903	156,845
Argentina	448,189	.....
Other countries	523,334	47,007
In sheets, strips and other forms	645,207	791,251
Zinc dust	356,308	206,101
Other zinc manufactures	268,638	603,19

Mining Stocks—Week Ended March 6, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	47⅛	42	46⅞	Ja.16,Fe.23,Q	0.75
Arcadian Consol.	Boston	*45	*35	*35		
Ariz. Com'l	Boston	11⅛	10⅛	11	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	3⅜	3⅛	3⅛		
Calumet & Arizona	New York	60⅛	58⅜	58⅜	Mr.5,Mr.21 QX	1.50
Calumet & Hecla	Boston	14⅛	14	14⅛	Nov 30,De.15 Q	0.50
Cerro de Pasco	New York	65	60⅛	63⅜	Ja. 14, Fe. 1, Q	1.00
Chile Copper	New York	34	30	33⅛	Ma.3, Ma.29, Q	0.62½
Chino	New York	20	16	16	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	2	1⅞	2		
Copper Range	Boston	18	16⅛	17⅛	May, 1925	1.00
Crystal Copper	Boston Curb	*47	*44	*44		
East Butte	Boston	4	3½	3½	Dec., 1919	0.50
First National	Boston Curb	*15	*15	*15	Feb., 1919	0.15
Franklin	Boston			*80		
Granby Consol.	New York	20⅛	18⅛	20	May, 1919	1.25
Greene-Cananea	New York	11⅛	10	11⅛	Nov., 1920	0.50
Hancock	Boston	*80	*80	*80		
HoweSound.new,r.t.c.	New York	34⅛	30	33⅛	Ja. 5, Ja. 15 Q	0.50
Inspiration Consl.	New York	24⅛	23	24⅛	Mar.18, Ap.5,Q	0.50
Iron Cap	Boston Curb	3⅛	3⅛	3⅛	May, 1923	0.15
Isle Royale	Boston	11⅛	11	11	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	1 1/16	1⅛	1⅛		
Kennecott	New York	55⅛	51⅞	53⅛	Ma.5,Ap.1 Q	1.00
Lake Copper	Boston	1⅛	1⅛	1⅛	June, 1925	0.50
Magma Copper	New York	42	38	42	De.31, Ja.15,	0.75
Mason Valley	N. Y. Curb	2⅛	1⅞	2		
Mass Consolidated	Boston	*40	*40	*40	Nov., 1917	1.00
Miami Copper	New York	12⅛	11	12	Feb.1, Feb.15 Q	0.25
Mohawk	Boston	32⅛	31	32⅛	Jan. 30, Ma.1 Q	1.00
Mother Lode Coa.	New York	7	6⅛	7	De. 11, De. 31	0.37½
Nevada Consol.	New York	13⅛	12⅛	13	De. 18, De.31 Q	0.25
New Cornelia	Boston	19⅛	19	19⅛	Fe.5, Fe.23 Q	0.30
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*65	*60	*60	No. 14, De. 2	0.05
Old Dominion	Boston	17⅛	17	17	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†135	†130		De.21, Ja.2 Q	1.00
Quincy	Boston	22⅛	20	20⅜	Mar., 1920	1.00
Ray Consolidated	New York	12⅛	10⅛	11⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			11⅞		
St. Mary's Min. Ld.	Boston	34⅛	32	33⅛	May, 1925	3.00
Seneca Copper	New York	7⅛	6⅛	7		
Shannon	Boston	*60	*50	*55	Nov., 1917	0.25
Shattuck Arizona	New York	59	51	56⅛	Jan.,1920	0.25
Superior & Boston	Boston	1 1/16	1 1/16	1 1/16		
Tenn. C. & C.	New York	14⅛	12⅞	13⅞	Fe.27,Ma.15,Q	0.25
United Verde Ex.	N. Y. Curb	29	27	29	Ja.5, Fe.1, Q	0.75
Utah Copper	New York	98	98	98	De.18, De.31,Q	1.25
Utah Metal & T.	Boston	1 1/16	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*75	*43	*75		
Walker Mining	Salt Lake	1.25	1.20	1.22½		
NICKEL-COPPER						
Internat. Nickel	New York	40	35⅛	38⅛	Ma.11,Ma.31,Q	0.50
Internat. Nickel, pfd.	New York	102⅛	102⅛	102⅛	Ja.25, Fe.1, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*37⅛	*37	*37	Ja. 1, Ja. 10 M	0.0⅛
National Lead	New York	159⅝	153⅛	156⅛	Ma.12,Ma.31 Q	2.00
National Lead pfd.	New York	116	116	116	Aug.21, Se.15	1.75
St. Joseph Lead	New York	44⅛	42⅛	43⅛	De.10,De.20 QX	1.50
ZINC						
Am. Z. L. & S.	New York	9⅛	8	9⅛	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	35⅝	30⅛	35	Nov., 1920	1.50
Butte C. & Z	New York	5⅛	5	5⅛	De.10, De.24	0.50
Butte & Superior	New York	14⅜	12⅛	14	Ma.15, Ma.31 Q	0.50
Callahan Zn-Ld	New York	2	1⅞	2	Dec., 1920	0.50
Eagle Picher	Cincinnati	31⅞	30⅜	30⅞	My. 15, Jn.1	0.40
Eagle Picher, pfd.	Cincinnati	...	...	110	Ja.1, 15.31	1.50
New Jersey Zn.	N. Y. Curb	...	...	208	Fe.10, Fe.28 Q	0.90
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*40	*37½	*40	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*35	*29	*35		
Barry-Hollinger	Toronto	*45	*32	*42		
Carson Hill	Boston	*40	*30	*35		
Consol. W. Dome L.	Toronto	*24	*19	*23		
Cresson Consol. G.	N. Y. Curb	2⅜	2⅛	2⅜	De.31, Ja. 7	0.10
Crown Reserve	Toronto	*21	*16	*18½	Jan., 1917	0.05
Dome Mines	New York	18⅜	16⅜	18⅜	De.31, Ja.20, Q	0.50
Golden Center	N. Y. Curb	1⅛	1⅛	1⅛		
Golden Cycle	Colo. Springs	†1.55	†1.51½		No.30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	19.15	17.50	18.45	Ma. 9, Ma. 25	0.08
Homestake Mining	New York	55⅛	51	55	Ma.20,Ma.25 M	0.50
Kirkland Lake	Toronto	1.19	*95	1.14		
Lake Shore	Toronto	11.95	9.50	10.87	Ma.1,Ma.15 Q	0.10
McIntyre-Porcupine	New York	25⅜	23¼	25⅛	Fe.1, Ma.7	0.05
Newray	Toronto	*41	*39	*39		
Night Hawk Pen.	Toronto	*7	*5	*6⅛		
Noranda	N. Y. Curb	14⅛	12⅛	14⅜		
Portland	Colo. Springs	†*54	†*52½		Oct., 1920	0.01
Rand Mines	New York			34⅜	Fe.16, Fe.26	1.52
Teck-Hughes	Toronto	3.44	2.85	3.28	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*50⅛	*50	*50	Ma.10,Ma.20	0.02
Tough-Oakes	Toronto	*56	*42⅛	*51		
United Eastern	N. Y. Curb	*46	*46	*46	July, 1924	0.05
Vipond Cons.	Toronto	1.75	1.50	1.69		
Wright-Hargreaves	Toronto	8.65	7.55	8.30	Ma.15,Ap.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	20	20	20		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	20⅜	17⅛	17⅜		
Con. Cortez	N. Y. Curb	*7	*8	*8		
Con. Virginia	San Francisco	*12⅛	*10⅛	*11⅛		
Continental Mines	N. Y. Curb	...	...	*45		
Dolores Esperanza	N. Y. Curb	60	60	60	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅜	2⅛	2 2/16	Ma.19, Apr.3	0.08
Tonopah Belmont	N. Y. Curb	3⅞	3⅞	3⅞	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	62	57	62	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	6⅞	6	6⅛	Se.30, Oc.21	0.07½
Unity Gold	N. Y. Curb	...	...	*20		
West End Consol.	N. Y. Curb	*25	*25	*25	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*45	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	1	1	1	Oct., 1920	0.50
Beaver Consol.	Toronto	*80	*62	*79	May. 1920	0.03
Castle-Trethewey	Toronto	1.71	1.43	1.62		
Coniagas	Toronto	4.30	4.25	4.25	May, 1924	0.12½
Keeley	Toronto	1.60	1.44	1.55	Ma. 1,Ma.15 X	0.12
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*33½	*21	*33	Apr., 1922	0.10⅛
Lorrain Trout Lake	Toronto	...	...	1	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*28⅛	*20	*27	Oct., 1920	0.03
Mining Corp. Can.	Toronto	4.20	3.68	3.97	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	6⅛	5⅛	6⅛	De.31, Ja.2, Q	0.15
Temiskaming	Toronto	...	...	*14	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8	7⅛	8	Ma.18,Ap.5,QX	0.25
Alta Merger	Salt Lake	†3	†1			
Bingham Mines	Boston	47⅛	44	47	Ma.20,Ma.31 Q	1.00
Cardiff M. & M.	Salt Lake	*57	*57	*57	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.45	3.40	3.40	Fe. 1,	0.10
Emma Silver	Salt Lake	†2	†⅛			
Erupcion	Boston Curb	1⅛	1⅛	1⅛	De.15, Ja.2, X	0.10
Federal M. & S.	New York	91	75	75		
Federal M. & S., pfd.	New York	73	61	70⅛	No.25, De.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*25	*18	*25		
Hecla Mining	N. Y. Curb	17⅜	15½	16⅛	Fe.15, Ma.15 Q	0.50
Iron King Mining	Salt Lake	*35	*33	*33		
Keystone Mining	Salt Lake	*51	*49	*51	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*18⅛	*18	*18		
Mammoth Mining	Salt Lake	3.00	3.00	3.00	De. 16, De. 23	0.10
Marsh Mines	Spokane	*9⅛	*6⅛	*8⅛	Se.15, Oc.1	0.15
Ontario Silver	New York			10		
Park Utah	Salt Lake	7.60	7.50	7.50	De.15, Ja.2	0.15
Prince Cons	Salt Lake	4	*75	4		
Silver King Coal	Salt Lake	9.40	9.30	9.30	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*47	*44	*45	De.31, Ja.10	0.02
Tamarack-Custer	Spokane	*37	*34	*34⅛	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.87½	13.75	13.75	De.16,De.23,QX	0.30
Utah-Apex	Boston	9⅛	8⅛	9⅛	Ja.1, Ja.5, Q	0.35
Western Utah Copper	N. Y. Curb	...	...	*8		
IRON						
Bethlehem Steel	New York	42	40⅛	40⅜	July, 1924	1.25
Colorado Fuel & Iron	New York	31⅛	27⅜	30	May, 1921	0.75
Gt. North'n Iron Ore	New York	26	24⅛	25⅛	De. 4, De. 28,	0.75
Inland Steel	New York	38	37⅛	37⅛	Fe.15, Ma.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅛	1⅛	1⅛		
Replogle Steel	New York	12⅛	10	11⅜		
Republic I. & S.	New York	53⅛	49⅛	52⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	94	93	93	Ma.15, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York			94½	Ma.10,Ma.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	117⅛	110	114	Ma.20, Ap.1, Q	1.75
U. S. Steel	New York	126	120	123⅜	Fe.27,Ma.30 XQ	1.75
U. S. Steel pfd.	New York	125⅞	124⅛	125⅞	Fe. 3, Fe. 27, Q	1.75
Virginia I. C. & C.	New York	43	42	42	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	73⅛	73⅛	73⅛	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	31	29	30⅛	Fe.1, Fe.15, Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	86	80	85	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	113	109	109	De.31, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	23⅜	19⅛	22⅛	Nov., 1919	1.00
Texas Gulf	New York	135½	125⅛	134	Ma.1, Ma.15,Q	2.50
DIAMONDS						
De Beers Consol.	New York	...	...	29	Ja.26, Fe.2	0.23
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	5⅛	3⅜	5		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	53⅛	49⅜	52⅛	Fe.18, Ma. 1, Q	1.00
Amer. Metal pfd.	New York	...	...	119	Fe. 19, Ma. 1, Q	1.75
Amer. Sm. & Ref.	New York	133	120	127	Ja.15, Fe.1,	1.75
Amer. Sm.&Ref.pfd.	New York	114⅜	113⅜	114	Fe.5,Ma .1, Q	1.75
Consol. M. & S.	N. Y. Curb	222	180	180	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	18⅛	17⅛	18⅛		
Newmont Mining	N. Y. Curb	54	49	50⅜	De.31, Ja.15,	0.60
Southwest Metals	N. Y. Curb	...	...	2		
U. S. Sm. R. & M.	New York	45	40	43⅜	Ja.1, Ja.7, Q	0.87½
U.S. Sm. R.&M.pfd.	New York	49⅛	49⅛	49⅛	Ja.1, Ja.7, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and Henry Sachs: Colorado Springs, Colo.

PRICE WEEK ENDED MARCH 6, 1926

Name	High	Low	Last		Last Divd. Date	Amount
Aramayo Mines (25 frs.)	81/3	79/—	80/—	Feb.	1926	5 p.c.†
British Platinum (£1)	6/6	6/3	6/3	Feb.	1925	2½ p.c.
Burma Corpn. (10 rupees)	17/7½	16/7½	16/7½	Feb.	1926	6 annas*
Bwana M'Kubwa (5s)	7/6	6/9	7/—			
Camp Bird (£1)	5/—	4/7½	4/—10½			
El Oro (£1)	6/9	6/6	6/6	Nov.	1924	2½ p.c.*
Esperanza (10s)	1/9	1/6	1/9			
Frontino & Bolivia (£1)	8/10½	8/9	8/9	Jan.	1926	1½ p.c.
Mexican Corpn. (£1)	20/9	20/—	20/3			
Mexico Mines of El Oro (£1)	33/9	32/6	33/9	Dec.	1925	12½ p.c.*
Nechi (pref. 10s)	1/6	1/—	1/3		1921–22	25 p.c.
Oroville Dredgng (£1)	4/—	3/9	4/—	Dec.	1923	3¾ p.c.
Ouro Preto (£1)	2/6	2/3	2/3	May	1925	2½ p.c.
St. John del Rey (£1)	10/9	10/1½	10/6	June	1925	6¼ p.c.
San Francisco Mines (10s)	31/—	29/9	30/3	Jan.	1926	22½ p.c.
Santa Gertrudis (£1)	21/1½	20/4½	21/—	July	1920	5 p.c.
Selukwe (2s. 6d.)	11/9	10/7½	10/9	April	1917	6¼ p.c.
S. Amer. Copper (2s.)	5/3	5/—	5/3	Nov.	1917	7.5 p.c.
Tanganyika (£1)	50/3	46/10½	48/1½	Sept.	1925	5 p.c.
Tomboy (£1)	3/1½	3/—	3/—	Jan.	1926	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	6.750	6.600	6.700	July	1925	150 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.